Ω6 AC Servo System

Instructions for Use

Wisdom-driven, freely controlled

Contents

Use method of the manual

Basic terms in manual

Basic terms	Meanings
Motor	It includes OM1 and OM2 series servo motors
Driver	It includes uniaxial pulse type and bus type servo drivers
Servo system	A complete set of servo control system formed by the upper computer control system, servo driver, servo motor and peripheral devices
Servo ON	Motor power-on
Servo OFF	Motor power-off
Servo lock	The state in which the motor is stopped by the zero command in the position loop.
Cable of main circuit	Cables connected with main circuit terminals (including main circuit power cables, control power cables and servo motor main circuit cables, etc.)
Ω Master	Upper computer debugging software for servo system setting and debugging

Writing plan of the manual

The "value setting type" for setting parameter values and the "function selection type" for selecting functions are written differently.

Value setting type

Parameter number

Parameter name, accessible properties and unit of data value

No. Pr6.09	NAME	NEGATIVE TORQUE COMPENSATION VALUE		SETTING ENABLED	IMMEDIATELY ENABLED	DATA RANGE	-100~100
	ACCESSIBILITY	RW	UNIT %	RELATED MODEL	P	FACTORY DEFAULT	0

- Set the dynamic friction compensation value added to the torque command when receiving the negative position command in the position control and full-closed loop control mode.
- This parameter is updated when the friction compensation mode of real-time automatic adjustment is active.

It indicates the time when the change becomes effective when the parameter is sent for change: the associated mode indicates that the parameter is associated with a control mode.

The data range is settable range pf the parameter, and the factory default is the factory default value.

Function selection type

No. Pr6.10	NAME	FUNCTION EXTENSION SETTING		SETTING ENABLED	IMMEDIATELY ENABLED	DATA RANGE	0~32768
	ACCESSIBILITY	RW	UNIT -	RELATED MODEL	ALL	FACTORY DEFAULT	0

Each function is set in bit units.
* The least bit is bit0.
*1 In case of encoder overheating alarm, Em15.1"Encoder overheating exception protection" will occur.

Writing reference

Writing reference of parameter Pr6.10

Set value and its high energy definition

	Function	Set value	
		0	1
bit0	Not used	Please fix bit 1	
bit1	Not used	Please fix bit 0	
bit3	Inertia ratio switching	Invalid	Valid
bit5	Analog torque FF	Invalid	Valid
bit10	Fault shutdown is PWM delay	Invalid	Valid
bit11	Detection of encoder overheat abnormality protection	Invalid	Valid
bit15	Slow stop function	Invalid	Valid

Upper computer software

The upper computer debugging software is Ω Master, and the user manual is detailed in Appendix A.

Icons

In order to help the reader understand the distinction between the contents of the description, the following icons are designed in this manual. These icons are used when necessary.

It indicates caution or restriction, as well as warnings.

It indicates precautions.

Safety precautions

Safety marks

Type and meaning of safety marks.
Please familiarize yourself with the manual and other ancillary materials before installation, wiring construction, maintenance, and inspection.
Please confirm equipment knowledge, safety information and precautions before use.
This manual grades safety precautions into two levels, that is, “danger” and “caution”.

Warning label	Meanings
 Danger	This mark means that misoperation may create a dangerous situation and thus result in death or severe injuries.
 Caution	This mark means that misoperation may create a dangerous situation and thus result in moderate or minor injuries or equipment damage.

In addition, depending on specific situations, an incidence marked as “caution” may also lead to serious consequences. The contents with a safety mark is the important part, please follow it.
The following indications show things that must be observed.

Signs	Meanings
	Indicates something that must not be done.
	Indicates something that must be done.

Precautions

Danger		
	Do not subject the Product to water, corrosive or flammable gases, and combustibles.	Failure to observe this instruction could result in fire, electrical shocks, damages and breakdowns.
	Do not place combustibles near by the motor, driverd regenerative resistor and dynamic brake resister..	
	Don't use the motor in a place subject to excessive vibration or shock.	Failure to observe this instruction could result in electrical shock, injury or fire.
	Don't use cables soaked in water or oil.	Failure to observe this instruction could result in electrical shocks, damages and breakdowns.
	The installation area should be away from heat generating objects such as a heater and a large wire wound resistor.	Failure to observe this instruction could result in fire and breakdowns
	Never connect the motor directly to the commercial power supply.	
	Don't attempt to carry out wiring or manual operation with wet hand.	Failure to observe this instruction could result in electrical shock, injury or fire.
	Do not put your hands in the servo driver.	Failure to observe this instruction could result in burn and electrical shocks.
	In the case of the motor with shaft end keyway, do not touch the keyway with bare hands.	Failure to observe this instruction could result in personal injury.
	Do not touch the rotating portion of the motor while it is running. Failure to observe this instruction could result in damages and breakdowns.	
	Do not drive the motor with external power.	Failure to observe this instruction could result in fire.
	Do not subject the cables to excessive force, heavy object, or pinching force, nor damage the cables.	Failure to observe this instruction could result in electrical shocks, damages and breakdowns.
	Installation area should be free from excessive dust, and from splashing water and oil.	Failure to heed this precaution will result in electric shock, personal injury, fire, malfunction or damage.
	Mount the motor, driver and peripheral equipments on incombustible material such as metal.	Installation on a flammable material may cause fire.

	Wiring has to be carried out by the qualified and authorized specialist.	Allowing a person with no expertise to carry out wiring will result in electrical shocks.
	Correctly run and arrange wiring.	Incorrect wiring will result in short circuit, electric shock, personal injury, etc.
	After correctly connecting cables, insulate the live parts with insulator.	Incorrect wiring will result short circuit, electric shock, fire or malfunction.
	Ground the earth terminal of the motor and driver without fail.	Floating ground circuit will cause electric shock.
	Install and mount the Product and machinery securely to prevent any possible fire or accidents incurred by earthquake.	Failure to heed this requirement will result in electric shock, personal injury, fire, malfunction or damage.
	Install an emergency stop circuit externally so that you can stop the operation and shut off the power immediately.	
	Install an overcurrent protection, earth leakage breaker, over-temperature protection and emergency stop apparatus without fail.	Failure to heed these requirements will result in electric shock, personal injury or fire.
	Check and confirm the safety of the operation after the earthquake.	
	Before transporting, wiring and inspecting the driver, turn off power and wait for a time longer than that specified on the name plate on the side panel of the product; and make sure that there is no risk of electrical shock.	Energized circuit will cause electric shock.

Caution		
	Do not hold the motor cable or motor shaft during the transportation.	Failure to observe this instruction could result in injuries.
	Don't drop or cause topple over of something during transportation or installation.	Failure to observe this instruction could result in injuries and breakdowns.
	Do not step on the Product nor place the heavy object on them.	Failure to observe this instruction could result in electrical shocks, injuries, breakdowns and damages.
	Don’t place any obstacle object around the motor and peripheral, which blocks air passage.	Temperature rise will cause burn injury or fire.
	Don't use the equipment under direct sunshine.	Failure to heed these instructions will cause personal injury or fire.
	Do not block the heat dissipating holes or put the foreign particles into them.	Failure to observe this instruction could result in electrical shocks and fire.
	Do not give strong impact shock to the Product.	Failure to observe this instruction could result in breakdowns.
	D Do not give strong impact shock to the motor shaft.	Failure to observe this instruction could result in a failure of the detector etc.

	Do not turn on and off the main power of the driver repeatedly.	Failure to observe this instruction could result in breakdowns.
	Never run or stop the motor with the electro-magnetic contactor installed in the main power side.	
	Do not make an extreme gain adjustment or change of the drive. Do not keep the machine running/operating unstably.	Failure to observe this instruction could result in injuries.
	Do not use the built-in brake as a "Braking" to stop the moving load.	Failure to observe this instruction could result in injuries and breakdowns.
	Do not approach to the machine since it may suddenly restart after the power resumption. Design the machine to secure the safety for the operator even at a sudden restart.	Failure to observe this instruction could result in injuries.
	Never attempt to perform modification, dismantle or repair.	Failure to heed this instruction will result in fire, electric shock, personal injury or malfunction.
	Make an appropriate mounting of the Product matching to its wight and output rating.	Failure to heed these requirements will result in personal injury or malfunction.
	Observe the specified mounting method and direction.	
	Use the eye bolt of the motor for transportation of the motor only, and never use this for transportation of the machine.	Using it for transportation of the machine will cause personal injury or malfunction.
	Adjust the motor and driver ambient environmental condition to match the motor operating temperature and humidity.	Failure to heed these requirements will result in personal injury or malfunction.
	Create the specified clearance between the driver and the control panel inner surface or other devices.	
	Observe the specified voltage.	Operation from a voltage outside the rated voltage will cause electric shock, personal injury or fire.
	Connect the brake control relay to the relay which is to shut off at emergency stop in series.	Missing of one of these devices will result in personal injury or malfunction.
	Provide protection device against idling of electromagnetic brake or gear head, or grease leakage from gear head.	No protection will cause personal injury, damage, pollution or fire.
	Use the motor and the driver in the specified combination.	Not using the motor and the driver in the specified combination will result in fire.
	Test-run the securely fixed motor without loading to verify normal operation, and then connect it to the mechanical system.	Operation using a wrong model or wrong wiring connection will result in personal injury.
	When any error occurs, remove the cause and release the error after securing the safety, then restart.	Not removing the cause of the error will result in personal injury.
	If the driver fails, shut off the power on the power supply side of the driver.	Allowing a large current to continue to pass will result in fire.
	Always keep power disconnected when the power is not necessary for a long time.	Improper operation will cause personal injury.

Conformed Standards

	Driver	Motor
CE standards	IEC61508-2 EN61800-5-2 EN61800-3	EN55011:2009+A1:2010 EN61000-6-2:2005 EN60034-1:2010 EN60034-5:2001 EN:60034-11:2004 EN:61800-5-1:2007
Other standards	ENISO13849-2	Pb, Hg, Cr6+, PBB, PBDE, DEHP, BBP, DBP, DIBP comply with the limits as set by Rohs (OM1)

IEC: International Electrotechnical Commission
EN: Europaischen Normen
EMC: Electromagnetic Compatibility
Safety parameters:

	When diagnosed according to EDM	When not diagnosed according to EDM
Safety integrity level	EN61508(SIL3) EN62061(SILCL3)	EN61508(SIL2) EN62061(SILCL2)
Performance level	ISO13849-1PLe(Cat.3)	ISO13849-1PLd(Cat.3)
Safety functions	Conform to SIL3 standard	Conform to SIL3 standard
Fault probability per hour	PFH=1.34×10-8(％SIL3=13.4%)	PFH=1.40×10-8(％SIL2=14.0%)
Mean time between failure	MTTFd: High(100 years)	MTTFd: High(100 years)
Mean self-diagnosis rate	DC: Medium	DC: Low
Task time	15years	15years

Warranty, maintenance and inspections

Warranty

Warranty period:
The warranty period is 1 year and 6 months from the date of shipment.
Warranty content:
Any failure during the warranty period can be repaired free of charge , according to the requirements of this instruction manual and under normal service conditions. However, the maintenance fees must be charged even during the warranty period in the following conditions.

(1) The damage is caused due to misuse, improper repair or modification.
(2) After arrival, the damaged is caused due to falling and transportation.
(3) The damage is caused due to the use outside the scope of product specifications.
(4) The damage is caused by fire, earthquake, lightning strike, wind disaster, chlorination corrosion, abnormal voltage and other natural disasters.
(5) The damage is caused due to the intrusion of water, oil, dust, metal fragments, orother foreignmaterials.
(6) Parts exceeding their standard lifetime specified in this document are excluded.

The warranty scope is limited to the main body of the purchased product, the company shall not be liable for any indirect, incidental or consequential damage or loss of any nature that may arise in connection with the product.

Maintenance and inspections

Please perform regular maintenance and inspection on the driver and motor for safe use.
Notes on maintenance and inspection:
1. The power should be cut off by the operators themselves. When erroneous actions occur during the power-on process, do not approach the motor and the machine it drives.
2. Within a short time after the power is cut off, the internal circuit remains in a high-voltage charging state. Please turnoff the power before inspection, wait for more than 15 minutes and make sure that the charging indicator is off.
3. Before carrying out insulation resistance test to the driver, please cut off all connections with the driver first. The implementation of insulation resistance test in the connected state will cause the driver to break down.
4. Do not use benzine, thinner, alcohol, acidic cleaner and alkaline cleaner, otherwise the shell may be discolored or damaged.

Inspection items and cycle:
Normal runningconditions

Ambient conditions: annual average environmental temperature: 30°C; loadfactor: <80%; daily running time: less than 20h

The daily and regular inspection should be implemented according to the following items.

Type	Cycles	Inspection items
Daily inspection	Daily	• Confirm operation temperature, humidity, dust, foreign matters, etc. • Whether there are abnormal vibrations and sounds • Whether power voltage is normal • Whether there is abnormal smell • Whether there are lint or other particles at air holes • Cleaning status of the front end and connector of driver • Whether the cablesis damaged • Whether the connecting parts with devices and equipment are loose or eccentric • Whether foreign objects have entered via the load
Regular inspection	Annual	• Whether fastened parts have become loose • Whether there is a tracof overheat • Whether terminal block is damaged • Whether the fastened parts of terminal block have become loose

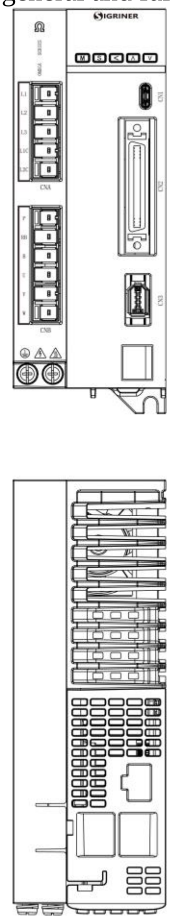
Guideline for parts replacement
The replacement time of parts varies according to environmental conditions and usage methods. Replacement (repair) is required when an exception occurs.

Prohibition	Do not allow any part other than the company to conduct dismantling and repair work

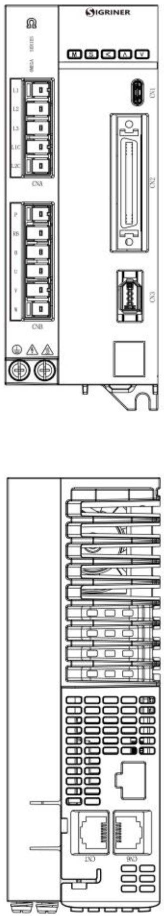
Product	Component	Standard replacement cycles (time)	Remarks
Driver	Smoothing condenser	About five years	Standard replacement cycle is only for reference. Once there is anything abnormal, replacement will be provided even if the standard replacement cycle has not expired.
	Cooling fan	2-3 years (10,000- 30,000h)	
	Aluminum electrolytic capacitor	About five years	
	Rush current preventive relay	About 100,000 times (depending on service condition)	
	Rush current preventive resistor	About 20,000 times (depending on service condition)	
Motor	Bearing	18,000h	
	Oil seal	5,000h	
	Encoder	3-5 years (20,000- 30,000h)	
	Absolute encoder battery	Please refer to Section 9.2.1.4 “Service life of battery”	

Chapter 1 “Before Using the Products”

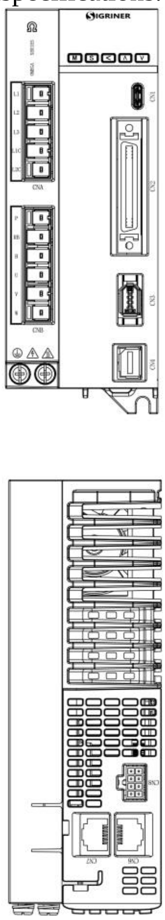
The Ω6 series drivers have basic type, general type and full-functionf type. This manual is prepared based on the full-function model. Part of the functions in the full-function model cannot be used in the basic model and general model.
The basic, general and full-function models have the following differentspecifications.



Basic model (B)



General model (G)



Full-function model (F)

Function	Basic model (B)	General model (G)	Full-function model (F)
USB communication	○	○	○
Modbus	○	○	○
Wifi		○	○
Safety functions			○
Command pulse input	○	○	○
Analog voltage input		○	○
The second encoder			○
High-speed DI (3 ways)		○	○
High-speed DO (2 ways)		○	○
High-speed probe		○	○
Flying beat		○	○
Gantry function			○
Black box		○	○
Contracting brake module		○	○

Function	Basic model (B)	General model (G)	Full-function model (F)
CN1	○	○	○
CN2	○	○	○
CN3	○	○	○
CN4			○
CN5		○	○
CN6	○	○	○
CN7	○	○	○
CN8			○

1.1 On Opening the Product Package

- Whether it is consistent with the model you have ordered.
- Whether the product is damaged or not during transportation.
- Whether it is equipped with power connector, motor connector, and safety plug (for full-function model)

1.2 Driver

1.2.1 Confirmation of model

1. Contents of nameplate

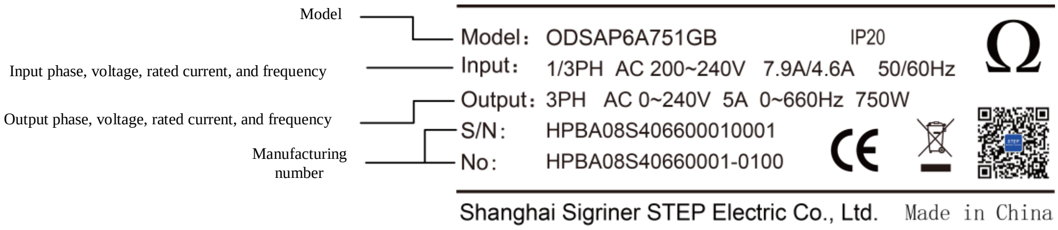


Figure1.2.1-1 Contents of nameplate (diagram)

2. Identification method of model

(1) Identification method of rotary servo model

ODSAP6	A	401	G	B	**
1-6	7	8-10	11	12	13-14

[1-6]Series ODSAP6: Ω6 series uniaxial pulse type ODSAN6: Ω6 series uniaxial bus type	[7]Voltage class A: AC 220V B: AC 380V	[8-10]Power specification 201: 200W 401: 400W 751: 750W 102: 1.0kW 152: 1.5kW 202: 2.0kW 302: 3.0kW ……
[11]Control model B: Basic model G: General model F: Full-function type	[12]Encoder type B: Serial port communication type	[13-14]Special specification Vacant: Standard

(2) Identification method of linear servo model

ODSAP6	A	3D2	G	B	L*
1-6	7	8-10	11	12	13-14

[1-6]Series ODSAP6: Ω6 series uniaxial pulse type ODSAN6: Ω6 series uniaxial bus type	[7]Voltage class A: AC 220V B: AC 380V	[8-10]Current rating 3D2: 3.2A 5D6: 5.6A 007: 7.0A 9D7: 9.7A ……
[11]Control model G: General model	[12]Encoder type B: Serial port communication type	[13-14]Special specification L: Standard

3. Table of outline model and specifications of driver

Frame-size	Power	Size (mm)
Model A	400W and below	150×150×45 (L×D×W)
Model B	750W-1.0kW	150×170×60 (L×D×W)
Model C	1.5kW	150×170×81.5 (L×D×W)
Model D	2.0kW-3.0kW	210×195×100 (L×D×W)

1.2.2 Confirmation of name of each part

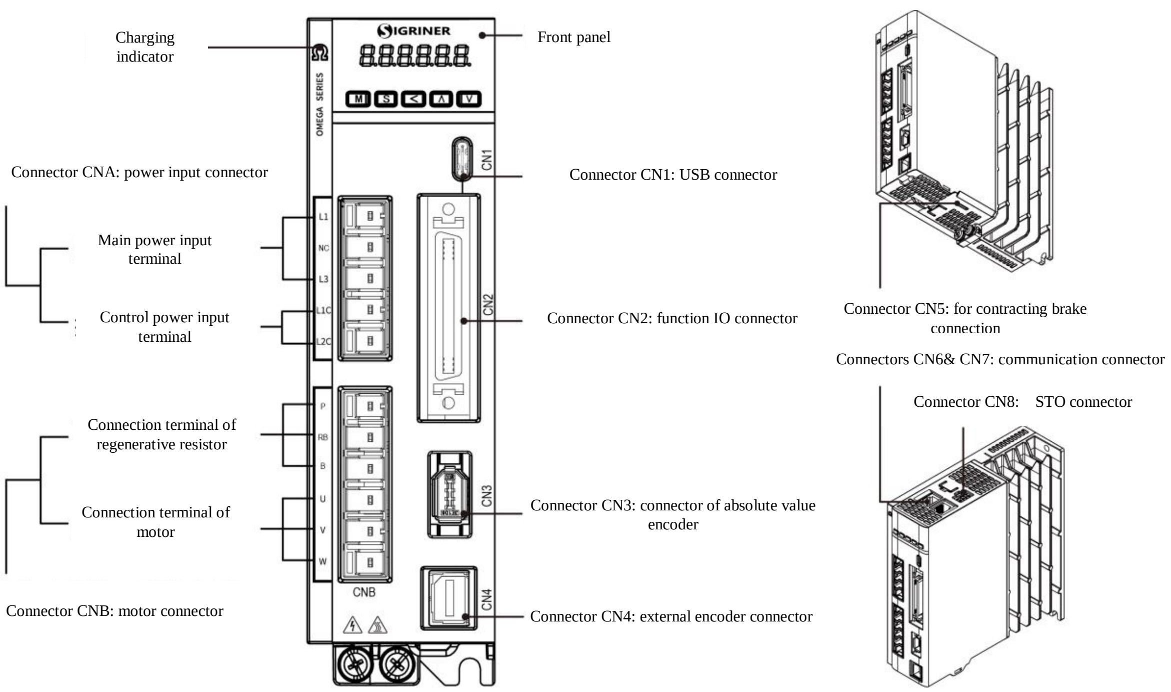


Figure 1.2.2.-1 Name of each part of type A driver

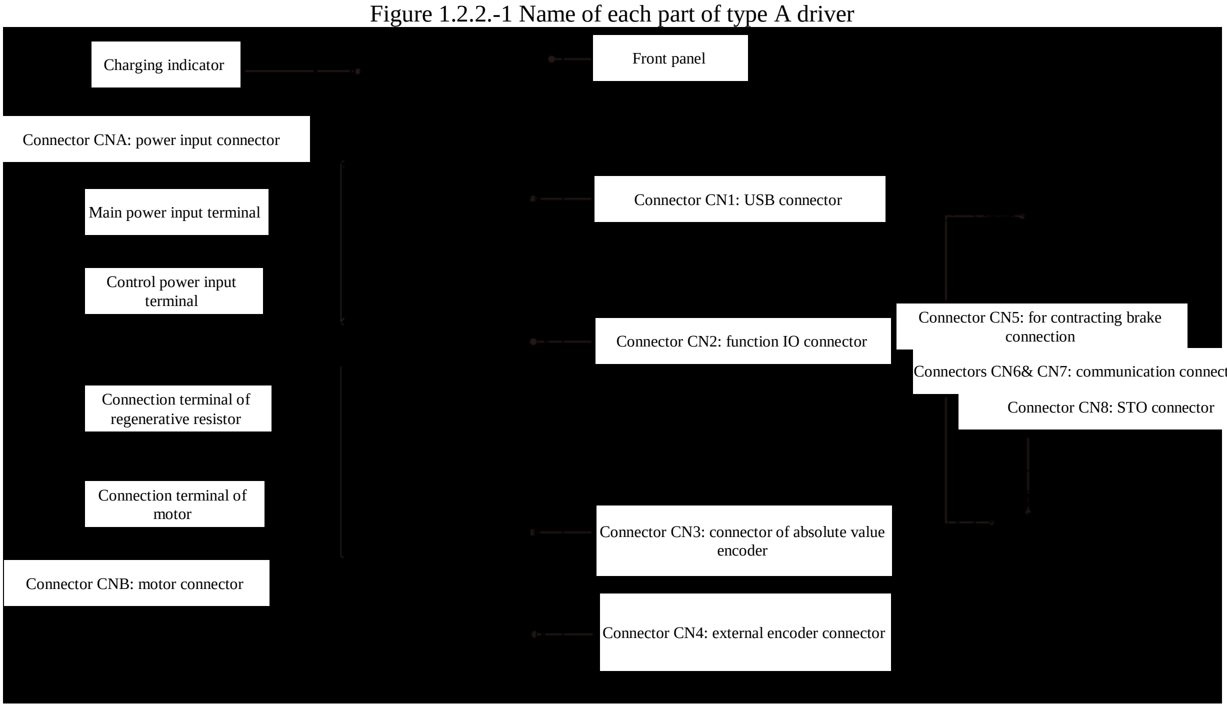


Figure 1.2.2-2 Name of each part of type B driver

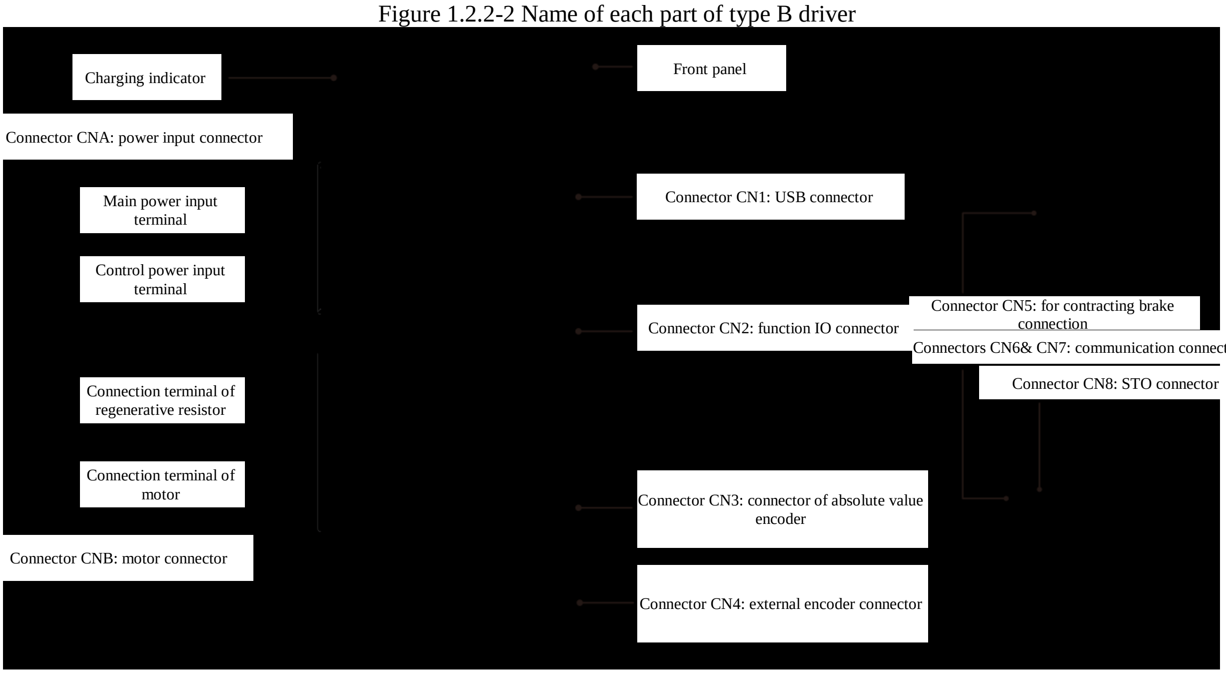


Figure 1.2.2-3 Name of each part of type C driver

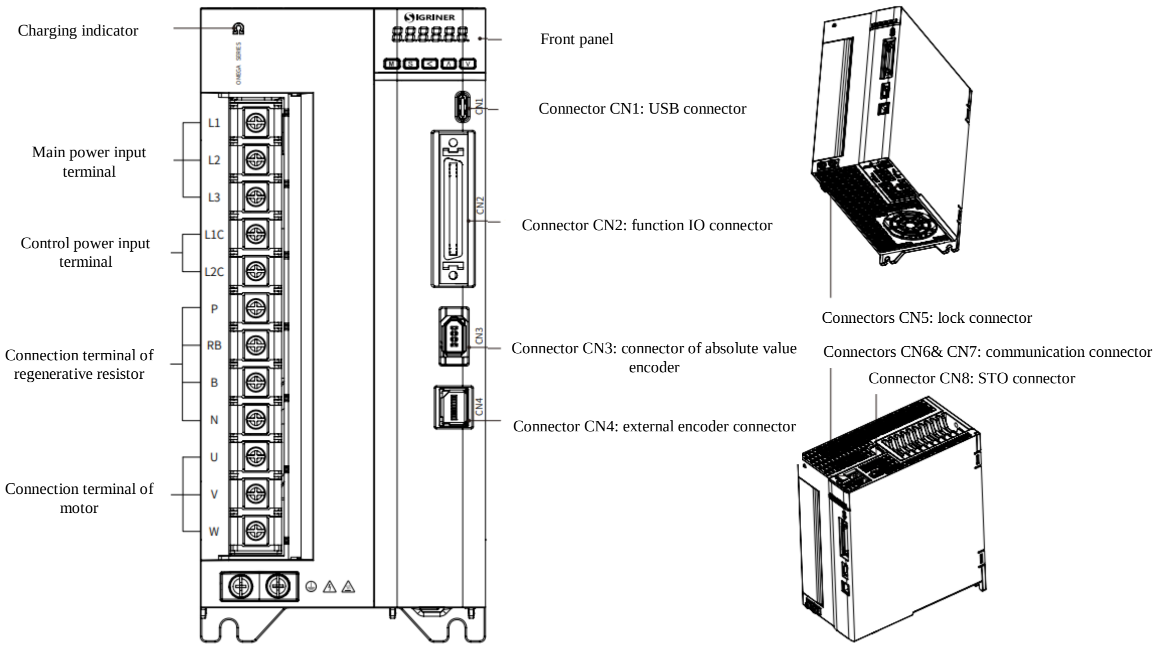


Figure 1.2.2-4 Name of each part of type D driver

1.2.3 Specifications

Full-function model (F)

Items					Descriptions
Basic specifications	Input power	200V series	Main circuit Power supply	Model A	Single-phase AC200V-240V, -15%-10%; 50/60Hz
				Model B-C	Single-phase/three-phase AC200V-240V, -15%-10%; 50/60Hz
				Model D	Three-phase AC200V-240V,-15%-10%;50/60Hz
			Power source of control circuit	Model A-D	Single-phase AC200V-240V, -15%-10%; 50/60Hz
	Insulation and voltage withstanding	AC1500V between primary and grounding, withstand voltage for 1 min (leakage trigger current: 20mA) (200V series))			
	Encoder feedback		The first encoder		17, 23 and 24-bit serial communication encoder
			The second encoder		16Mbps ABZ encoder
	Service conditions		Operating temperature		-5℃-55℃ (no freezing)
			Storage temperature		-20℃-85℃
			Service/storage humidity		Below 95% RH (no freezing and condensation)
			Vibration resistance		Below 5.88 m/s^2,10-60 Hz (can not be used continuously at the resonant frequency)
			Impact resistance		$19.6 m/s^2$
			Altitude		Use normally in the altitude below 1000m, and use derating in the altitude of 1000m-2000m.
	IO interface connector	Digital signal		Input	10-way general input, including 3-way high-speed DI Select the function of general input according to the parameters
				Output	6-way general output, including 2-way high-speed DO Select the function of general output according to the parameters
		Analog signal		Input	3-way 16bit A/D, ±10V

			Output	2-way 12bit D/A, ±10V
		Pulse signal	Input	2 Input Differential input 16Mpps maximally, pulse width cannot be less than 62.5ns Optocoupler input 1Mpps maximally, pulse width cannot be less than 2us (5V, 12V and 24V inputs are supported)
			Output	4 Output Differential output of Phases A, B and Z Open collector output of Phase Z
	Communication function	USB (Type-C)		Computer can be connected for servo adjustment, parameter setting, status monitoring, etc.
		Modbus		It is used for 1:n communication of PLC, and supports Modbus-RTU and ASCII modes, with settable baud rate of 2400bps-230400bps
		Wifi (Type-C)		The wireless communication of AP and STA modes is supported via Wifi module.
	Safety terminal			Terminal of corresponding safety function
	Front panel			5-digit key, 6-digit LED display
	Indicator tape			It is used for servo status display. When there is no abnormality, it presents blue breathing light effect (not enabled) or blue constant light (enabled); red breathing light effect when warning; the red constant light in case of an alarm.
	Braking resistor			Model A/D: without built-in braking resistor (only external) Model B/C: with built-in braking resistor (external ones are also OK)
	Dynamic brake			Model A-D: built-in
	Control mode			① Position control; ② Speed control; ③ Torque control; ④ Position/speed control; ⑤ Position/torque control; ⑥ Speed/torque control; ⑦ Full closed-loop control 7 control modes can be switched according to parameters
Function	General	Automatic adjustment		Under the driving state of the motor, the load inertia is estimated and judged in real time by the upper action command and the action command issued by the installation and debugging software Ω Master, and the gain corresponding to the rigidity setting is automatically set.
		Frequency division function of feedback pulse		The number of pulses can be set arbitrarily (but it cannot exceed the number of feedback pulses from the encoder)
		Protection functions	Hardware error	Overvoltage, undervoltage, overspeed, overload, overcurrent, encoder abnormality, etc.
			Software error	Excessive position deviation, frequency division of command pulse, EEPROM parameter abnormality, etc.
		The function of tracking alarm data		Refer to the historical records of alarm data
		Infinite rotation absolute function		Available
	Position control	Control input		Deviation counter clearing, command pulse inhibiting input, command frequency division and multiplication switching, vibration control switching, etc.
		Control output		Positioning end, etc.
		Pulse input	Maximum command pulse frequency	1M pulse/s (optocoupler input) 16M pulse/s (differential input)
			Input pulse signal form	Optocoupler input or differential input, input type and model form can be selected according to the parameters. (①Positive direction/negative direction ② phase A/B ③ command/direction)

			Command pulse frequency division and multiplication	Command pulse frequency ×electronic gear ratio ($\frac{1\sim2^{30}}{1\sim2^{30}}$) is processed as position command input However, please use electronic gear ratio of 1/1000-8000 times.
			Smoothing filter	A delay filter or an FIR type filter can be selected for the command input
		Analog amount Input	Torque limit Command input	Set the torque limit in each direction respectively.
			Torque feedforward Input	Input torque feedforward according to the analog voltage.
		Vibration control		Up to 4 can be used simultaneously
		V type vibration control filter		Up to 1 can be used simultaneously
		2 degrees of freedom		Available
		Load change inhibition control		Available
		Position comparison output function		Available
	Speed Control	Control input		Internal common speed selection 1, Internal common speed selection 2, Internal common speed selection 3 and Zero clamping
		Control output		Speed reached
		Analog input	Speed command Input	Input the speed command according to the analog voltage
			Torque limit Input command	Set the torque limit in each direction respectively
			Torque feedforward Input	Input torque feedforward according to the analog voltage
		Internal speed command		Switch 8 internal speeds according to control input
		Soft start/power off function		0-10S/1000r/min, acceleration and deceleration set separately
		Zero clamping		Set the internal speed command to 0 according to zero clamping input
		2 degrees of freedom		Available
		Load change inhibition control		Available
		Position comparison output function		Unavailable
	Torque control	Control input		Zero clamping and torque command symbol input, etc.
		Control output		Speed reached
		Analog input	Torque command Input	Input torque command according to the analog voltage
		Speed limit function		Set the speed limit value according to the parameters.
		2 degrees of freedom		Unavailable
		Load change inhibition control		Unavailable
		Position comparison output function		Unavailable
	Full-closed loop control	Control input		Deviation counter clearing, command pulse inhibiting input, command frequency division and multiplication switching, vibration control switching, etc.
		Control output		Positioning end, etc.
		Pulse	Maximum	1M pulse/s (optocoupler input)

		input	command pulse frequency	16M pulse/s (differential input)
			Input pulse signal form	Optocoupler input or differential input, input type and model form can be selected according to the parameters. (① Positive direction/ negative direction ② Phase A/B ③ Command + direction)
			Command pulse frequency division and multiplication	Command pulse frequency ×electronic gear ratio ($\frac{1\sim2^{30}}{1\sim2^{30}}$) is processed as position command input However, please use electronic gear ratio of 1/1000-8000 times.
			Smoothing filter	A delay filter or an FIR type filter can be selected for the command input
		Analog input	Torque limit Command input	Set the torque limit in each direction respectively
		Setting range of frequency division and frequency multiplication of second decoder		1/ 40 ~ 1280 times The ratio of the encoder feedback pulse (molecule) to the external displacement sensor pulse (denominator) can be set arbitrarily in the range of numerator of 1 ~ 2^{23} and denominator of 1 ~ 2^{23}, but should be used in the above range.
		Vibration control		Up to 4 can be used simultaneously
		V type vibration control filter		Unavailable
		2 degrees of freedom		Unavailable
		Load change inhibition control		Available
		Position comparison output function		Available

General model (G)

Items					Descriptions
Basic specifications	Input power	200V series	Main circuit Power supply	Model A	Single-phase AC200V-240V, -15%-10%; 50/60Hz
				Model B-C	Single-phase/three-phase AC200V-240V, -15%-10%; 50/60Hz
				Model D	Three-phase AC200V-240V, -15%-10%; 50/60Hz
			Power source of control circuit	Model A-D	Single-phase AC200V-240V, -15%-10%; 50/60Hz
	Insulation and voltage withstanding	AC1500V between primary and grounding, withstand voltage for 1 min (leakage trigger current: 20mA) (200V series)			
	Encoder feedback		The first encoder		17, 23 and 24-bit serial communication encoder
	Service conditions		Operating temperature		-5°C-55°C (no freezing)
			Storage temperature		-20°C-85°C
			Service/storage humidity		Below 95% RH (no freezing and condensation)
			Vibration resistance		Below 5.88m/s2, 10∽60Hz (can not be used continuously at the resonant frequency)
			Impact resistance		19.6m/ s^2
			Altitude		Use normally in the altitude below 1000m, and use derating in the altitude of 1000m-2000m.

	IO interface connector	Digital signal	Input	10-way general input, including 3-way high-speed DI Select the function of general input according to the parameters
			Output	6-way general output, including 2-way high-speed DO Select the function of general output according to the parameters
		Analog signal	Input	3-way 16bit A/D, ±10V
			Output	2-way 12bit D/A, ±10V
		Pulse signal	Input	2 Input Differential input 16Mpps maximally, pulse width cannot be less than 62.5ns Optocoupler input 1Mpps maximally, pulse width cannot be less than 2us (5V, 12V and 24V inputs are supported)
			Output	4 Output Differential output of Phases A, B and Z Open collector output of Phase Z
	Communication function	USB (Type-C)		Computer can be connected for servo adjustment, parameter setting, status monitoring, etc.
		Modbus		It is used for 1:n communication of PLC, and supports Modbus-RTU and ASCII modes, with settable baud rate of 2400bps-230400bps
		Wifi (Type-C)		The wireless communication of AP and STA modes is supported via Wifi module.
	Front panel			5-digit key, 6-digit LED display
	Indicator tape			It is used for servo status display. When there is no abnormality, it presents blue breathing light effect (not enabled) or blue constant light (enabled); red breathing light effect when warning; the red constant light in case of an alarm.
	Braking resistor			Model A/D: without built-in braking resistor (only external) Model B/C: with built-in braking resistor (external ones are also OK)
	Dynamic brake			Model A-D: built-in
	Control mode			① Position control ② Speed control ③ Torque control ④ Position/speed control ⑤ Position /torque control ⑥ Speed /torque control 6 control modes can be switched according to parameters
Function	General	Automatic adjustment		Under the driving state of the motor, the load inertia is estimated and judged in real time by the upper action command and the action command issued by the installation and debugging software Ω Master, and the gain corresponding to the rigidity setting is automatically set.
		Frequency division function of feedback pulse		The number of pulses can be set arbitrarily. (But it cannot exceed the number of feedback pulses from the encoder)
		Protection functions	Hardware error	Overvoltage, undervoltage, overspeed, overload, overcurrent, encoder abnormality, etc.
			Software error	Excessive position deviation, frequency division of command pulse, EEPROM parameter abnormality, etc.
		The function of tracking alarm data		Refer to the historical records of alarm data
		Infinite rotation absolute function		Available
	Position control	Control input		Deviation counter clearing, command pulse inhibiting input, command frequency division and multiplication switching, vibration control switching, etc.
		Control output		Positioning end, etc.
		Pulse input	Maximum command pulse frequency	1M pulse/s (optocoupler input) 16M pulse/s (differential input)

			Input pulse signal form	Optocoupler input or differential input, input type and model form can be selected according to the parameters. (①Positive direction/negative direction ② phase A/B ③ command/direction)
			Command pulse frequency division and multiplication	Command pulse frequency ×electronic gear ratio ($\frac{1\sim2^{30}}{1\sim2^{30}}$) is processed as position command input However, please use electronic gear ratio of 1/1000-8000 times.
			Smoothing filter	A delay filter or an FIR type filter can be selected for the command input
		Analog input	Torque limit Command input	Set the torque limit in each direction respectively
			Torque feedforward Input	Input torque feedforward according to the analog voltage
		Vibration control		Up to 4 can be used simultaneously
		V type vibration control filter		Up to 1 can be used simultaneously
		2 degrees of freedom		Available
		Load change inhibition control		Available
		Position comparison output function		Available
	Speed Control	Control input		Internal common speed selection 1, Internal common speed selection 2, Internal common speed selection 3 and Zero clamping
		Control output		Speed reached
		Analog amount Input	Speed command Input	Input the speed command according to the analog voltage
			Torque limit Input command	Set the torque limit in each direction respectively
			Torque feedforward Input	Input torque feedforward according to the analog voltage
		Internal speed command		Switch 8 internal speeds according to control input
		Soft start/power off function		0-10S/1000r/min, acceleration and deceleration set separately
		Zero clamping		Set the internal speed command to 0 according to zero clamping input
		2 degrees of freedom		Available
		Load change inhibition control		Available
		Position comparison output function		Unavailable
	Torque control	Control input		Zero clamping and torque command symbol input, etc.
		Control output		Speed reached
		Analog input	Torque command Input	Input torque command according to the analog voltage
		Speed limit function		Set the speed limit value according to the parameters
		2 degrees of freedom		Unavailable
		Load change inhibition control		Unavailable

		Position comparison output function	Unavailable

Basic type (B)

Items					Descriptions
Basic specifications	Input power	200V series	Main circuit Power supply	Model A	Single-phase AC200V-240V, -15%-10%; 50/60Hz
				Model B-C	Single-phase/three-phase AC200V-240V, -15%-10%; 50/60Hz
				Model D	Three-phase AC200V-240V, -15%-10%; 50/60Hz
			Power source of control circuit	Model A-D	Single-phase AC200V-240V, -15%-10%; 50/60Hz
	Insulation and voltage withstanding	AC1500V between primary and grounding, withstand voltage for 1 min (leakage trigger current: 20mA) (200V series)			
	Encoder feedback		The first encoder		17, 23 and 24-bit serial communication encoder
	Service conditions		Operating temperature		-5℃-55℃ (no freezing)
			Storage temperature		-20℃-85℃
			Service/storage humidity		Below 95% RH (no freezing and condensation)
			Vibration resistance		Below 5.88 m/s^2,10-60 Hz (can not be used continuously at the resonant frequency)
			Impact resistance		19.6m/s^2
			Altitude		Use normally in the altitude below 1000m, and use derating in the altitude of 1000m-2000m.
	IO interface connector	Digital signal		Input	General input 7-way Select the function of general input according to the parameters
				Output	General output 4-way Select the function of general output according to the parameters
		Pulse signal		Input	2 Input Differential input 16Mpps maximally, pulse width cannot be less than 62.5ns Optocoupler input 1Mpps maximally, pulse width cannot be less than 2us (5V, 12V and 24V inputs are supported)
				Output	4 Output Differential output of Phases A, B and Z Open collector output of Phase Z
	Communication function		USB (Type-C)		Computer can be connected for servo adjustment, parameter setting, status monitoring, etc.
			Modbus		It is used for 1:n communication of PLC, and supports Modbus-RTU and ASCII modes, with settable baud rate of 2400bps-230400bps
	Front panel				5-digit key, 6-digit LED display
	Indicator tape				It is used for servo status display. When there is no abnormality, it presents blue breathing light effect (not enabled) or blue constant light (enabled); red breathing light effect when warning; the red constant light in case of an alarm.
	Braking resistor				Model A/D: without built-in braking resistor (only external) Model B/C: with built-in braking resistor (external ones are also OK)
	Dynamic brake				Model A-D: built-in
	Control mode				① Position control ② Speed control ③ Torque control ④ Position/speed control ⑤ Position /torque

				control ⑥ Speed /torque control 6 control modes can be switched according to parameters
Function	General	Automatic adjustment		Under the driving state of the motor, the load inertia is estimated and judged in real time by the upper action command and the action command issued by the installation and debugging software Ω Master, and the gain corresponding to the rigidity setting is automatically set.
		Frequency division function of feedback pulse		The number of pulses can be set arbitrarily. (But it cannot exceed the number of feedback pulses from the encoder)
		Protection functions	Hardware error	Overvoltage, undervoltage, overspeed, overload, overcurrent, encoder abnormality, etc.
			Software error	Excessive position deviation, frequency division of command pulse, EEPROM parameter abnormality, etc.
		The function of tracking alarm data		Refer to the historical records of alarm data
		Infinite rotation absolute function		Available
	Position control	Control input		Deviation counter clearing, command pulse inhibiting input, command frequency division and multiplication switching, vibration control switching, etc.
		Control output		Positioning end, etc.
		Pulse input	Maximum command pulse frequency	1M pulse/s (optocoupler input) 16M pulse/s (differential input)
			Input pulse signal form	Optocoupler input or differential input, input type and model form can be selected according to the parameters. (①Positive direction/negative direction ② phase A/B ③ command/direction)
			Command pulse frequency division and multiplication	Command pulse frequency ×electronic gear ratio ($\frac{1\sim2^{30}}{1\sim2^{30}}$) is processed as position command input However, please use electronic gear ratio of 1/1000-8000 times.
			Smoothing filter	A delay filter or an FIR type filter can be selected for the command input
		Vibration control		Up to 4 can be used simultaneously
		V type vibration control filter		Up to 2 can be used simultaneously
		2 degrees of freedom		Available
		Load change inhibition control		Available
		Position comparison output function		Available
	Speed Control	Control input		Internal common speed selection 1, Internal common speed selection 2, Internal common speed selection 3 and Zero clamping
		Control output		Speed reached
		Internal speed command		Switch 8 internal speeds according to control input
		Soft start/power off function		0-10S/1000r/min, acceleration and deceleration set separately
		Zero clamping		Set the internal speed command to 0 according to zero clamping input
		2 degrees of freedom		Available
		Load change inhibition control		Available
		Position comparison output function		Unavailable
		2 degrees of freedom		Unavailable

		Load change inhibition control	Unavailable
		Position comparison output function	Unavailable

1.2.4 Block diagram

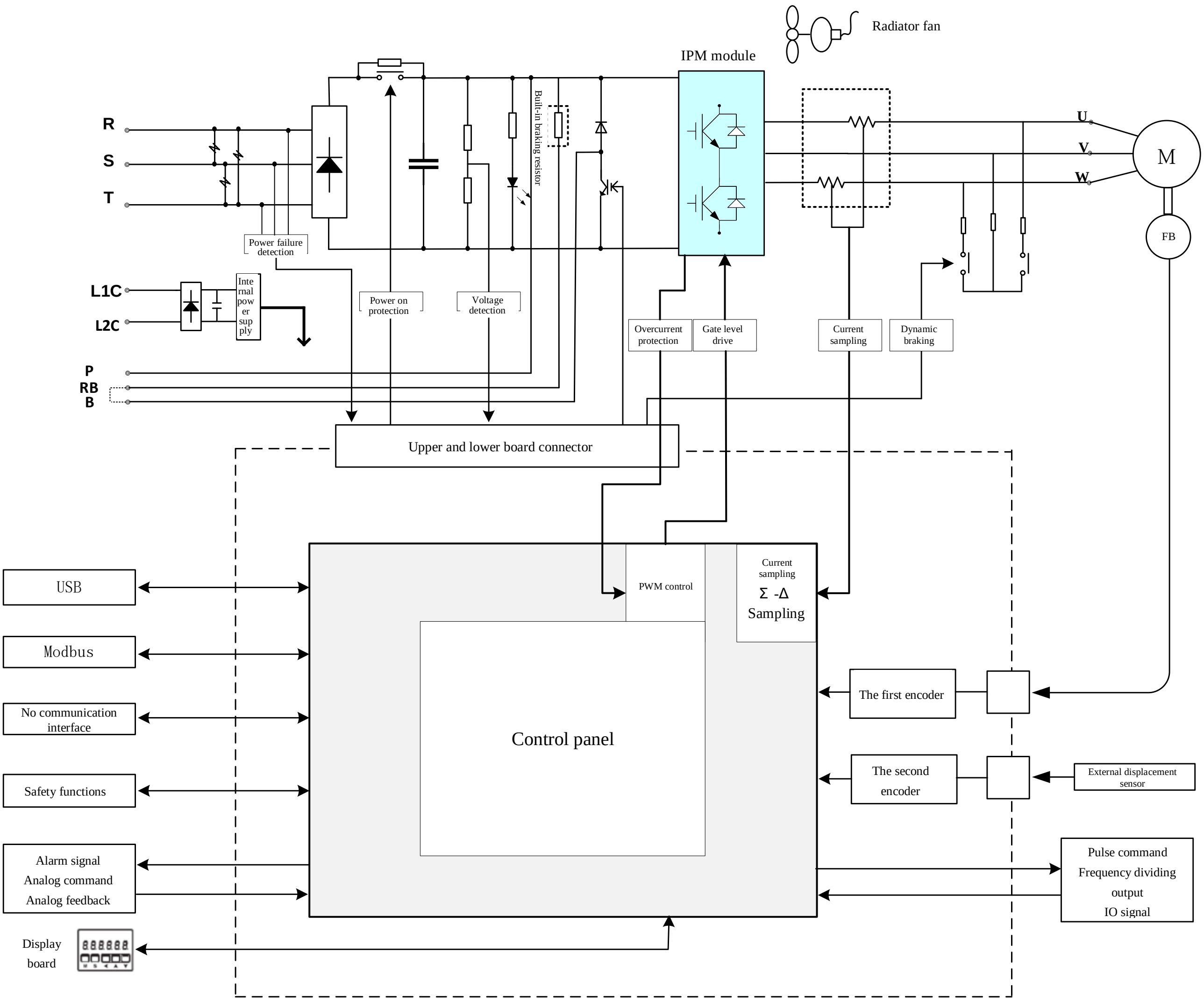


Fig. 1.2.4-1 System block diagram

1.3 Motor

1.3.1 Check of the model

1. Contents of nameplate

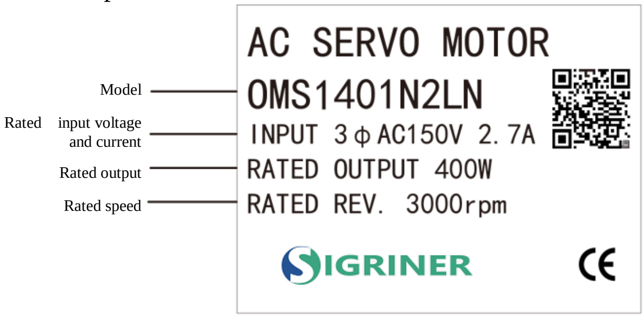


Fig. 1.3.1-1 Contents of nameplate (diagram)

2. Model designation

OM	S	1	401	N	2	L	N	**
1-2	3	4	5-7	8	9	10	11	12-13

[1-2]Product series OM: Ω series servo motor	[3]Inertia specification S: Low inertia M/D: Medium inertia G/H: High inertia	[4]Internal code 1: OM1 series motor 2: OM2 series motor
[5-7]Motor rated output 500: 50W 102: 1.0kW 101: 100W 152: 1.5kW 201: 200W 202: 2.0kW 401: 400W 302: 3.0kW 751: 750W 851: 850W 951: 1.0kW 132: 1.3kW 182: 1.8kW	[8]With or without brake N: Without brake A: With brake	[9]Voltage class 2: 220V
[10]Shaft end specification S: Round shaft without oil seal K: Keyway without oil seal T: Round shaft with oil seal L: Keyway with oil seal	[11]Encoder specification N: 17-bit incremental A: 17-bit absolute D: 23-bit incremental F: 23-bit absolute	[12-13]Special specification Vacant: Standard

①When installing a motor with a reducer in the axial direction, please use a motor with an oil seal to prevent the reducer oil from leaking into the motor.
②The standard interval to replace the oil seal is 5000 hours.
③80 flange 1.0kW is denoted by 951.

1.3.2 Parts description

1.OMS1(200W-1.0kW((□80)), OMM1(50W, 100W), OMD1(50W-400W), OMH1(200W-750W)

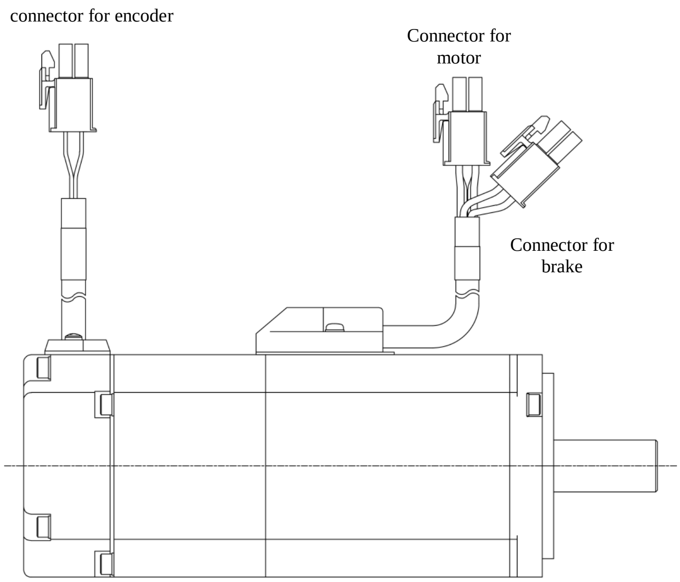


Fig. 1.3.2-1 Parts description

2.OMS1 (1.0kW((□100)-2.0kW), OMM1 (1.0kW-2.0kW, OMG1 (850W, 1.3kW), OMH1 (1.0kW, 1.5kW)

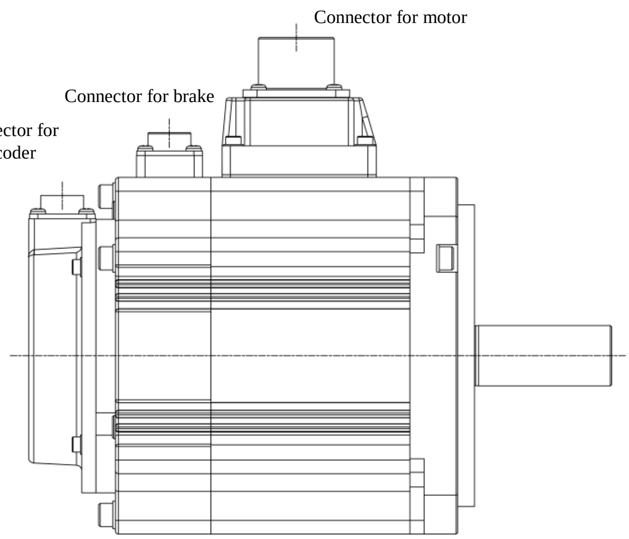


Fig. 1.3.2-2 Parts description

3.OMS2(100W-1.0kW), OMH2(200W-1.0kW((□80))

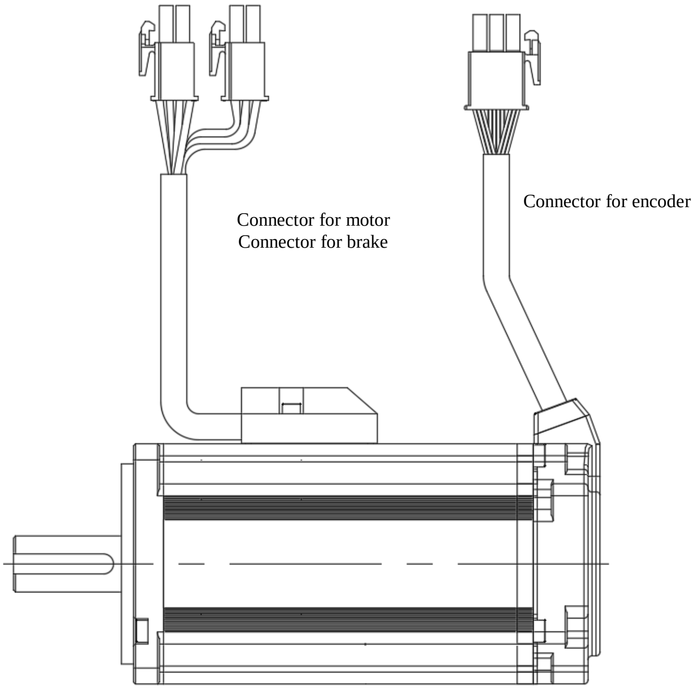


Fig. 1.3.2-3 Parts description

4.OMM2(1.0kW-3.0kW), OMG2(850W-1.8kW), OMH2(1.0kW((□130)-3.0kW)

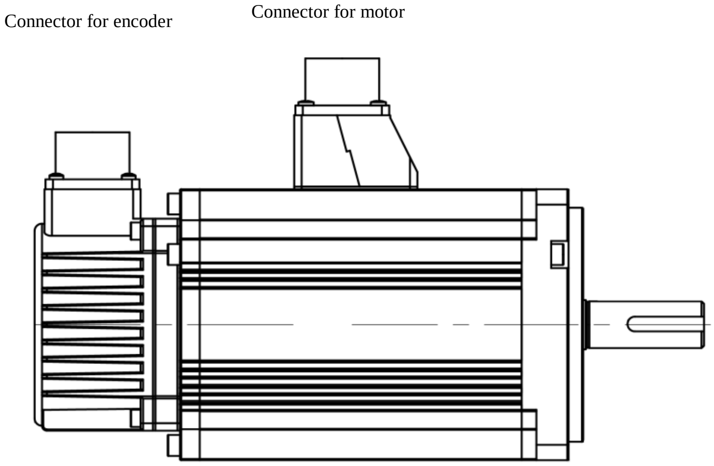


Fig. 1.3.2-4 Parts description

1.4 Combination of the driver and the motor

1.4.1 OM1 motor

<table>
<tr><th colspan="6">Motor</th><th>Driver</th></tr>
<tr><th>Power supply</th><th>Type</th><th>Rated speed</th><th>Model</th><th>Mounting flange</th><th>Rated output</th><th>Model</th></tr>
<tr><td rowspan="2">Single-phase 220V</td><td rowspan="7">OMS1 Low inertia</td><td rowspan="7">3000r/min</td><td>OMS1201</td><td>□60</td><td>200W</td><td>ODSA□6A201□B</td></tr>
<tr><td>OMS1401</td><td>□60</td><td>400W</td><td>ODSA□6A401□B</td></tr>
<tr><td rowspan="5">Single-phase/three-phase 220V</td><td>OMS1751</td><td>□80</td><td>750W</td><td>ODSA□6A751□B</td></tr>
<tr><td>OMS1951</td><td>□80</td><td>1.0kW</td><td>ODSA□6A102□B</td></tr>
<tr><td>OMS1102</td><td>□100</td><td>1.0kW</td><td>ODSA□6A102□B</td></tr>
<tr><td>OMS1152</td><td>□100</td><td>1.5kW</td><td>ODSA□6A152□B</td></tr>
<tr><td>OMS1202</td><td>□100</td><td>2.0kW</td><td>ODSA□6A202□B</td></tr>
<tr><td rowspan="2">Single-phase 220V</td><td rowspan="5">OMM1 Medium inertia</td><td rowspan="2">3000r/min</td><td>OMM1500</td><td>□40</td><td>50W</td><td>ODSA□6A201□B</td></tr>
<tr><td>OMM1101</td><td>□40</td><td>100W</td><td>ODSA□6A201□B</td></tr>
<tr><td rowspan="3">Single-phase/three-phase 220V</td><td rowspan="3">2000r/min</td><td>OMM1102</td><td>□130</td><td>1.0kW</td><td>ODSA□6A102□B</td></tr>
<tr><td>OMM1152</td><td>□130</td><td>1.5kW</td><td>ODSA□6A152□B</td></tr>
<tr><td>OMM1202</td><td>□130</td><td>2.0kW</td><td>ODSA□6A202□B</td></tr>
<tr><td rowspan="4">Single-phase 220V</td><td rowspan="4">OMD1 Medium inertia</td><td rowspan="4">3000r/min</td><td>OMD1500</td><td>□10</td><td>50W</td><td>ODSA□6A201□B</td></tr>
<tr><td>OMD1101</td><td>□40</td><td>100W</td><td>ODSA□6A201□B</td></tr>
<tr><td>OMD1201</td><td>□60</td><td>200W</td><td>ODSA□6A201□B</td></tr>
<tr><td>OMD1401</td><td>□60</td><td>400W</td><td>ODSA□6A401□B</td></tr>
<tr><td rowspan="2">Single-phase/three-phase 220V</td><td rowspan="2">OMG1 High inertia</td><td rowspan="2">1500r/min</td><td>OMG1851</td><td>□130</td><td>850W</td><td>ODSA□6A102□B</td></tr>
<tr><td>OMG1131</td><td>□130</td><td>1.3W</td><td>ODSA□6A152□B</td></tr>
<tr><td rowspan="2">Single-phase 220V</td><td rowspan="5">OMH1 High inertia</td><td rowspan="3">3000r/min</td><td>OMH1201</td><td>□60</td><td>200W</td><td>ODSA□6A201□B</td></tr>
<tr><td>OMH1401</td><td>□60</td><td>400W</td><td>ODSA□6A401□B</td></tr>
<tr><td rowspan="3">Single-phase/three-phase 220V</td><td>OMH1751</td><td>□80</td><td>750W</td><td>ODSA□6A751□B</td></tr>
<tr><td rowspan="2">2000r/min</td><td>OMH1102</td><td>□130</td><td>1.0kW</td><td>ODSA□6A102□B</td></tr>
<tr><td>OMH1152</td><td>□130</td><td>1.5kW</td><td>ODSA□6A152□B</td></tr>
</table>

1.4.2 OM2 motor

Motor						Driver
Power supply	Type	Rated speed	Model	Mounting flange	Rated output	Model
Single-phase 220V	OMS2 Low inertia	3000r/min	OMS2101	□40	100W	ODSA□6A201□B
			OMS2201	□60	200W	ODSA□6A201□B
			OMS2401	□60	400W	ODSA□6A401□B
Single-phase/three-phase 220V			OMS2751	□80	750W	ODSA□6A751□B
			OMS2951	□80	1.0kW	ODSA□6A951□B
Single-phase/three-phase 220V	OMM2 Medium inertia	2000r/min	OMM2102	□130	1.0kW	ODSA□6A102□B
			OMM2152	□130	1.5kW	ODSA□6A152□B
			OMM2202	□130	2.0kW	ODSA□6A202□B
			OMM2302	□130	3.0kW	ODSA□6A302□B
Single-phase/three-phase 220V	OMG2 High inertia	1500r/min	OMG2851	□130	850W	ODSA□6A102□B
			OMG2132	□130	1.3kW	ODSA□6A152□B
			OMG2182	□130	1.8kW	ODSA□6A202□B
Single-phase 220V	OMH2 High inertia	3000r/min	OMH2201	□60	200W	ODSA□6A201□B
			OMH2401	□60	400W	ODSA□6A401□B
Single-phase/three-phase 220V			OMH2751	□80	750W	ODSA□6A751□B
			OMH2951	□80	1.0kW	ODSA□6A102□B
		2000r/min	OMH2102	□130	1.0kW	ODSA□6A102□B
			OMH2152	□130	1.5kW	ODSA□6A152□B
			OMH2202	□130	2kW	ODSA□6A202□B
			OMH2302	□130	3kW	ODSA□6A302□B

1.5 Installation

1.5.1 Driver

Install the driver properly to avoid a breakdown or an accident.

1. Application places

(1) Install the driver in a control panel enclosed in noncombustible material and placed indoor where the product is not subjected to rain or direct sunlight. The products are not waterproof.(2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, sulfur, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas.(3) Where the motor is free from grinding oil, oil mist, iron powder or chips.(4) Well-ventilated and low humidity and dust-free place.(5) Vibration-free place.(6) Do not use benzine, thinner, alcohol, acidic cleaner and alkaline cleaner because they can discolor or damage the exterior case.2. Environmental conditions

Items	Conditions
ambient temperature	-5℃ to 55℃ (free from freezing)
ambient humidity	Lower than 95% RH (free from freezing and condensation)
Storage temperature	-20℃ to 85℃
Storage humidity	Lower than 95% RH (free from freezing and condensation)
Vibration	Lower than 5.88 m/s^2, 10Hz to 60Hz (Do not continuously use the driver for along time at the resonance point.)
Altitude	Lower than 1000m

3. Installation methods and notes

(1) Rack-mount type. Install in vertical position, and reserve enough space around the servo driver for ventilation.

(2) Base mount (rear mount) is standard.

(3) In consideration of strength of the screws and the material of the mounting base, select appropriate fastening torque for the product mounting screws, so that the screws will not be loosened or damaged. Example) To tighten a steel screw into a steel base: M4 1.2 N ·m to 1.7 N ·m

(4) Reserve enough surrounding space for effective cooling.

(5) Install fans to provide uniform distribution of temperature in the control cabinet.

(6) Observe the environmental conditions of the control cabinet described in the previous page.

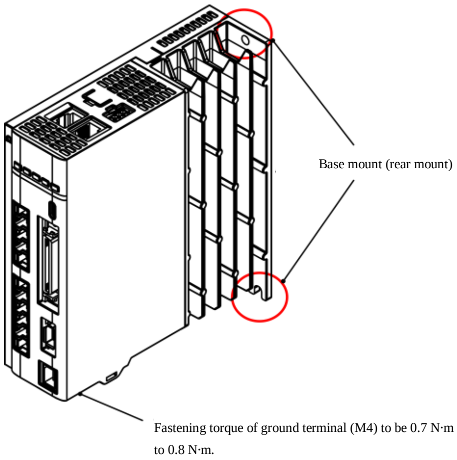


Fig. 1.5.1-1 Mounting holes of A-frame driver

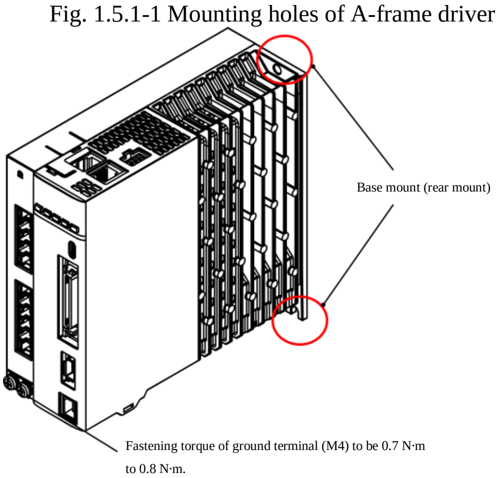


Fig. 1.5.1-2 Mounting holes of B-frame driver

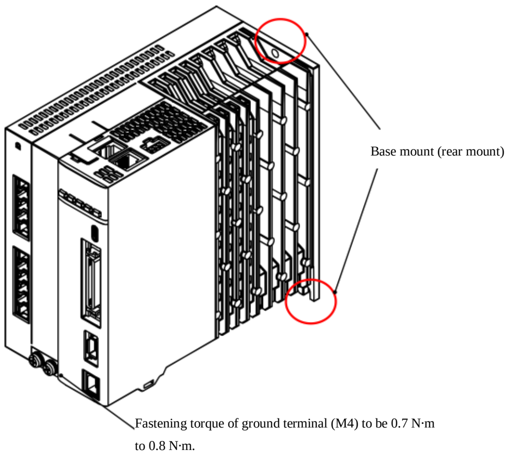


Fig. 1.5.1-3 Mounting holes of C-frame driver

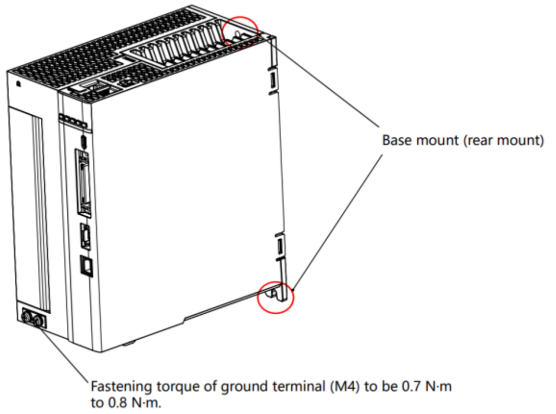


Fig. 1.5.1-4 Mounting holes of D-frame driver

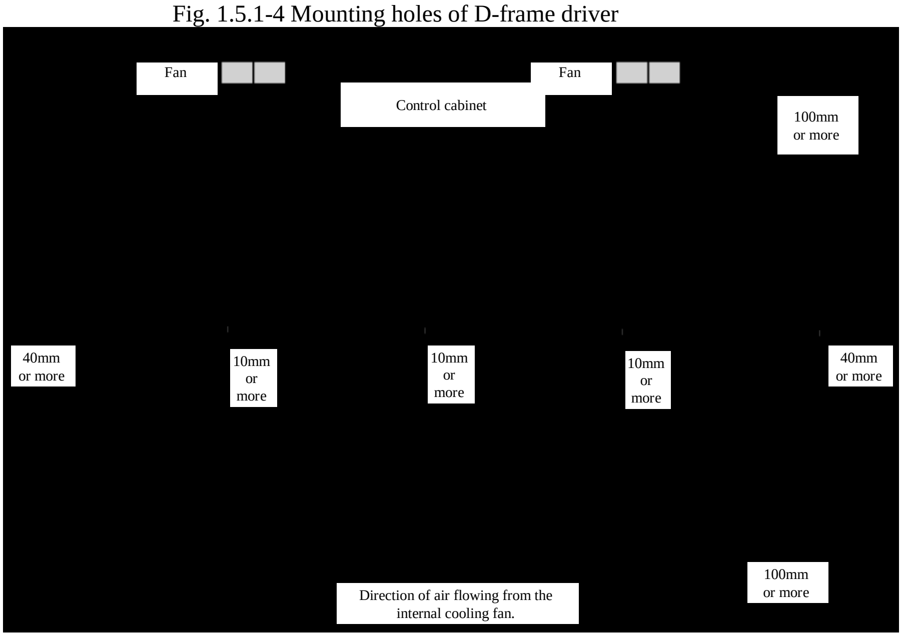


Fig. 1.5.1-5 Mounting direction and spacing

4. Recommended cables for driver

(1) For the main circuit, use electric wire that withstands at least 600 VAC with temperature rating 75˚C or higher.

(2) Use heat-resistant wires when the ambient temperature is high. Common polyvinyl chloride wires will deteriorate by heat at a higher rate. The surface of vinyl chloride insulation becomes hardened and brittle at low temperature and needs specific protective measure when used in cold region

(3) Bend radius of the cable must be 10 times or more its finish outside diameter.

5. Relationship between wire diameter and permissible current

When selecting a cable, refer to the following selection guide showing relationship between cable specification and current carrying capacity.

Example: Power supply 3-phase, 200 V, 35 A, ambient temperature 30 ℃

Determine the fundamental permissible current according to the cable conductor material(example: stranded copper wire).

nominal cross section of stranded conductor (mm^2)	Fundamental permissible current of copper wire (A)
0.75	6
0.75 to 1.5	15
2 to 3.5	27
3.5 to 5.5	37
5.5 to 8	49

Next, determine the number of conductors. (In this example, the cable contains 4 conductors (3 + ground).) Determine the applicable permissible current using the following formula. Applicable permissible current= fundamental permissible current × current reduction coefficient × current correction coefficient= 37 × 0.7 × 1.414 ≈ 36.6 (A). This permissible value is larger than 35 A to be carried though the cable. Therefore,

according to the list of recommended eco-cables, the cable to be selected for the cable with nominal cross section 3.5 mm^2 is a polyethylene-insulated heat-resistant 4-conductor power cable having 13.5 mm finish O.D. (approx. 14.5 mm with shield).
The current correction coefficient is determined using the following formula:
$\sqrt{(\text{Max. permitted temperature} - \text{Ambient temperature}) \div 30}$. The current correction coefficient is determined according to the cable. Check the specification of the cable used. The current reduction coefficient is shown as follows:

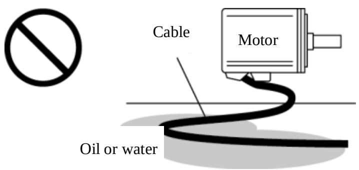
Number of wires in a tube	Current reduction coefficient
Up to 3	0.70
4	0.63
5 or 6	0.56
7 to 15	0.49
16 to 40	0.43
41 to 60	0.39
61 or more	0.34

1.5.2 Motor

Install the motor properly to avoid a breakdown or an accident.
1. Application places
Since the conditions of location affect a lot to the motor life, select a place which meets the conditions below.
(1) Please install the motor indoors free from rain or direct sun beam.
(2) Where the products are not subjected to corrosive atmospheres such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, sulfur, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas.
(3) Where the motor is free from grinding oil, oil mist, iron powder or chips.
(4) Well-ventilated and humid and dust-free place, far apart from the heat source such as a furnace.
(5) Easy-to-access place for inspection and cleaning.
(6) Vibration-free place.
(7) Avoid enclosed place. Motor may get hot in those enclosure and shorten the motor life.
2. Environmental conditions

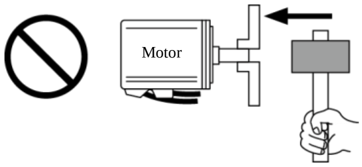
Items		Conditions
Ambient temperature		0℃ to 55℃
Ambient humidity		20% to 85%RH
Storage temperature		-20℃ to 65℃
Storage humidity		20% to 85%RH
Vibration	Motor only	Lower than 49 m/s^2 (5G) at running, 24.5 m/s^2 (2.5G) at stall
Impact	Motor only	Lower than 98 m/s^2 (10G)
Enclosure rating	Motor connector	IP65 (except rotating portion of output shaft and connecting pin part of the motor connector and the encoder connector) IP67 (IP67 for OMG1 series motor, except rotating portion of output shaft and connecting pin part of the motor connector and the encoder connector)
Altitude		Lower than 1000m

3. Installation methods
You can mount the motor either horizontally or vertically as long as you observe the following.
(1) Horizontal mounting
Mount the motor with cable outlet facing downward for water/oil countermeasure.
(2) Vertical mouting
Use the motor with oil seal when mounting the motor with gear reducer to prevent the reducer oil/grease from entering to the motor.
4. Oil or water protection
(1) Don't submerge the motor cable to water or oil.
(2) Install the motor with the cable outlet facing downward.
(3) Avoid a place where the motor is always subjected to oil or water.
(4) Use the motor with an oil seal when used with the gear reducer, so that the oil may not enter to the motor through shaft.

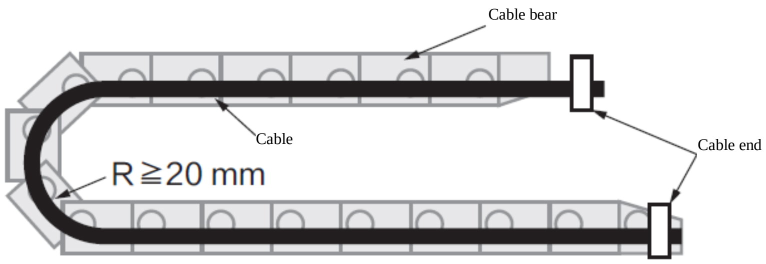


5. Stress to cables
(1) Avoid a stress application to the cable outlet and connecting portion by

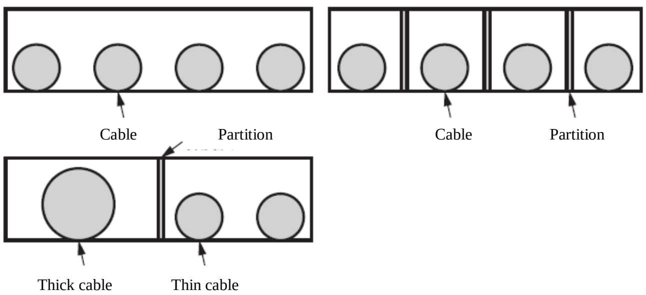
bending or self-weight.
(2) Especially in an application where the motor itself travels, fix the junction cable into the bearer so that the stress by bending can be minimized.
(3) Take the cable bending radius as large as possible, minimum R20 mm.
6. Permissible load to output shaft
(1) Design the mechanical system so that the applied radial load and/or thrust load to the motor shaft at installation and at normal operation can meet the permissible value specified to each model.
(2) Pay an extra attention when you use a rigid coupling. (Excess bending load may damage the shaft or deteriorate the bearing life.)
(3) Use a flexible coupling with high stiffness designed exclusively for servo application in order to make a radial thrust caused by micro misalignment smaller than the permissible value.



7. Notes on installation
(1) Do not apply direct impact to the shaft by hammer while attaching/detaching a coupling to and from the motor shaft. (Or it may damage the encoder mounted on the other side of the shaft.)
(2) Make a full alignment. Incomplete alignment may cause vibration and damage the bearing.
(3) If the motor shaft is not electrically grounded, it may cause electrolytic corrosion to the bearing depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Check and verification by customer is required
8. Wiring precautions on movable section
When wiring cable bear, take the following precautions.
●Cable bear wiring
(1) The bending radius of the cable must be 10 times or more its finish outside diameter.
(2) Do not fix or bundle wires in the cable bear. When securing the cable, fix it only at non-movable ends of the cable bear where the cable is free from any stress (e.g. tension). (Avoid tight lock.)

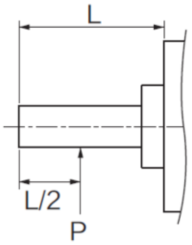


Do not keep the cable loosened (too long) or under tension (too short). Otherwise, the sheath will be cracked by internal wall of the cable bear, tangled by other cable, etc., causing unpredictable troubles.
● Cable distortion
Keep the cable free from twists or kinks. Distorted cable will cause loose connection, lowering performance and reliability.
●Lamination factor of cable in cable bear
(1) Place cables on a flat surface in parallel without bringing them into contact with each other and measure the dimension necessary to cover these cables. Then select a cable bear which is wider than the measured dimension.
(2) The lamination factor of cables should be lower than 60 % (recommended factor is 30 % or below).
(3) Do not run smaller and larger size cables in the same cable bear. Thin cables may break under the pressure of thick cables. If it is necessary to mix cables of different size, isolate them by using suitable separating material such as partition.

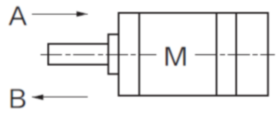


1.6 Permission load to output shaft

Radial load (P) direction



Thrust load (A, B) direction



1.6.1 OM1 series motor

Unit: N (1kgf=9.8N)

Motor series	Motor output	Radial load	Thrust load in A, B direction
OMS1	200W, 400W	68	58
	750W, 1.0kW (□80)	392	147
	1.0kW (□100), 1.5kW, 2.0kW	490	196
OMM1	50W, 100W	68	58
	1.0kW, 1.5kW, 2.0kW	490	196
OMD1	50W, 100W	68	58
	200W, 400W	245	98
OMG1	850W	490	98
	1.3kW	686	343
OMH1	200W, 400W	245	98
	750W	392	147
	1.0kW, 1.5kW	490	196

1.6.2 OM2 series motor

Unit: N (1kgf=9.8N)

Motor series	Motor output	Radial load	Thrust load in A, B direction
OMS2	100W	68	58
	200W, 400W	245	98
	750W, 1.0kW	392	147
OMM2	1.0kW, 1.5kW, 2.0kW	490	196
	3.0kW	784	343
OMG2	850W, 1.3kW, 1.8kW	686	196
OMH2	200W, 400W	245	98
	750W, 1.0kW (□80)	392	147
	1.0kW (□130), 1.5kW	490	196
	2.0kW, 3.0kW	784	343

Chapter 2 Interface Signals and Connection

2.1 Composition of peripheral equipment

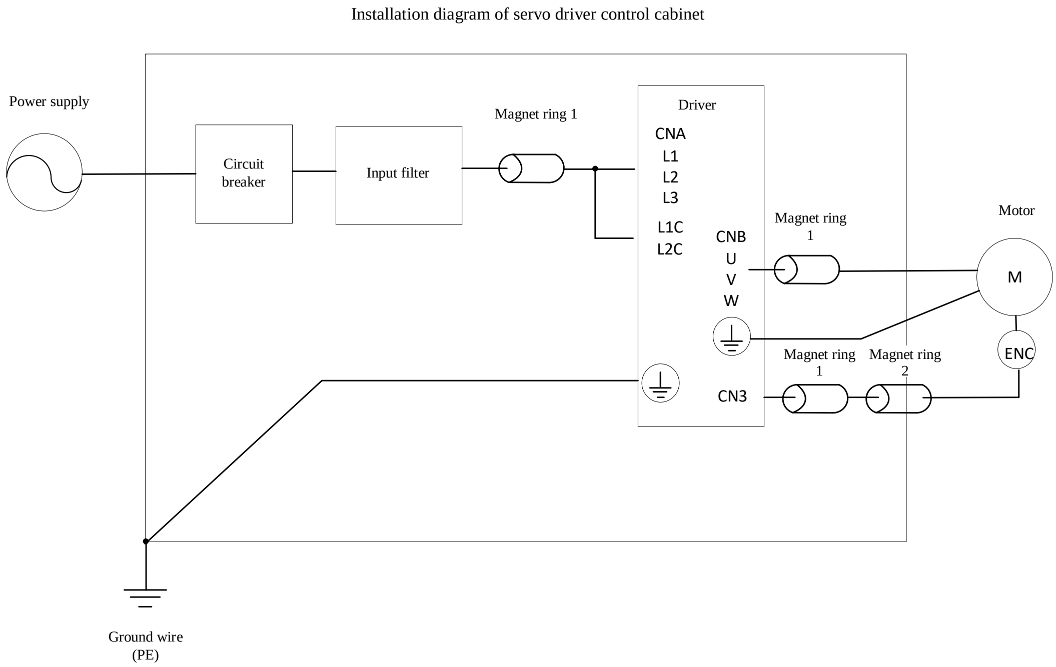


Fig. 2.1-1 Control box diagram

● Necessary conditions applicable to CE certification standards

- ◆ Install the driver on the metal housing (control cabinet)
- ◆ Connect the input filter to the input power line ·
- ◆ Insert the driver input and output cables in the magnetic ring, as shown in the figure
- ◆ The complete machine shall be grounded (PE) and the shielded cable of the encoder shall also be grounded

1. Residual current circuit breaker

(1) This servo driver is directly connected to industrial power lines. To prevent crossing electric shock accidents in a servo system, please make sure to use wiring residual current circuit breaker (RCD) or fuse.

(2) Please use model B residual current circuit breakers stipulated in IEC60947-2 and JISC8201-2-2.

2. Power line

(1) Please tie the power cable tightly. In order to avoid interference, pay attention to the distance between the power cable and the signal line.

(2) For the connect between the power line to the terminal of the driver, the power line must be pressed into the rod terminal E1512.

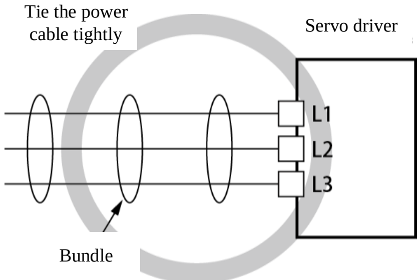


Fig. 2.1-2 Power cable installation precautions

3. Ground wire

(1) Be sure to connect the ground terminal of the driver and the ground wire of the control cabinet to avoid electric shock.
(2) Do not make multiple connections to the ground terminal of the driver.
(3) The connection between the ground wire and the driver must be pressed into the insulated circular terminal RV1.25-4
4. Control cabinet structure
The cable output and input port on the control cabinet, the installation hole of the operation panel and the door may have electromagnetic interference during the use of driver. To prevent the occurrence of this case, design and select the control cabinet according to the following matters:
(1) Use a metal control cabinet (with electrical conductivity).
(2) Use a conductor not electrically charged.
(3) Please ground all parts and enclosures installed in the control box.
5. Improvement of anti-interference ability of control input and output signals
When controlling input and output, interference is the cause of abnormal input and output signals.
(1) The DC 24V power supply for the control should be isolated from the other power supply of the brake. Do not connect the same power supply. In addition, do not connect the same ground wire, otherwise the input and output signals will be abnormal.
(2) Separate the control signal line and the driver power cable. Do not place them in the same trunking.
(3) Please use shielded wire as signal line, and the shielded wire should be grounded.
(4) Please use the driver at a pollution level 2 or 1 as specified in IEC60664-1.
6. Installation of magnetic ring
Description of magnetic ring selection

Description	Application	Driver model	Optional part model	Manufacturer model	Manufacturer name	Number
Magnet ring 1	Input power line and output motor line	400W, 750W	CH1	ZCAT3035-1330(-BK)	TDK	1※1
Magnet ring 2	Encoder cable	400W, 750W	CH2	RH28*30*13.5	Yancheng Jianni Electronics Co., Ltd.	2※2

※1. Circle input cables L1, L2 and L3 together two rounds; circle the motor lines (U,V,W) together two rounds.
※2. Circle the encoder wires together for three rounds. Fasten a magnetic ring 1.
Description of magnetic ring installation method
Do not put excessive pressure on the cable while fixing the ferrite core. When the power cable is provided with a wire sheath, the sheath must be removed. Put the finished L1, L2 and L3 power cables into the ferrite core to reduce interference. If this does not work, increase the number of surround coils of ferrite core. When installing the ferrite core on the motor line, put the finished U, V and W lines into the ferrite core to reduce interference. Put the signal wire into the ferrite core, and wind it according to the actual need. Increase the number of winding turns when the interference is large.

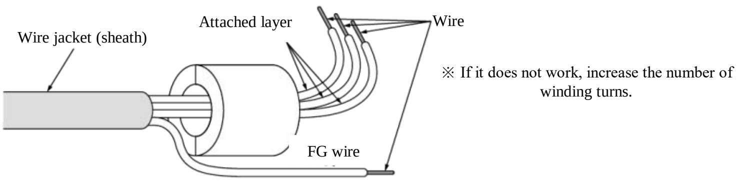
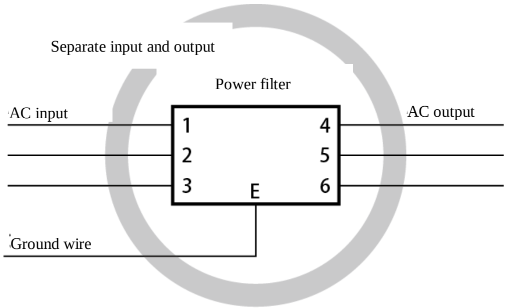


Fig. 2.1-3 Magnetic ring connection diagram

7. Power filter
Select a noise filter that matches the power capacity (considering load conditions). Consult the manufacturers for detailed specifications of the power filter. Consult the power filter manufacturer if it is required to set a power filer to use a number of servo drivers. Please use the same model of cable to connect the input and output terminals of the power filter, so as to reduce interference.



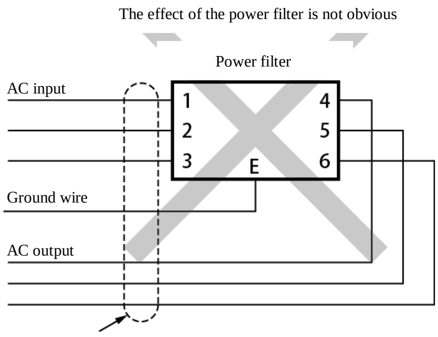


Fig. 2.1-4 Power filter connection precautions

8. Recommended models of power filter:

Single-phase input filter

Optional parts model	Driver voltage specification	Manufacturer model	Applicable model	Manufacturer
Single-phase input filter -400	Single-phase 200V	HJ4-16A-T(002)	400W~750W	Yancheng Jianni Electronics Co., Ltd.
Single-phase input filter -1000	Single-phase 200V	JN4-16A-T(020)	1kW~1.5kW	Yancheng Jianni Electronics Co., Ltd.

Three-phase input filter

Optional part model	Driver voltage specification	Manufacturer model	Applicable model	Manufacturer
Three-phase input filter-400	Single-phase 200V	JN310A-10A	400W, 750W	Yancheng Jianni Electronics Co., Ltd.
Three-phase input filter-1000	Single-phase 200V	JN310A-10A	1kW, 1.5kW	Yancheng Jianni Electronics Co., Ltd.

9. Recommended cables and terminals

Single-phase /three-phase voltage specification	Rated output	Power capacity (at rated load)	Diameter and withstand voltage value of cable for main power supply	Terminal of main power supply	Diameter and withstand voltage value of cable for control power	Terminal of control power supply	Diameter and withstand voltage value of cable for motor	Diameter and withstand voltage value of cable for brake
Three-phase 220V	400W	About 0.9KVA	0.75mm^2/AWG18; Above 600VAC	 Tube-shaped cold-pressed terminal E1512  Circular cold-pressed terminal RV1.25-4	0.75mm^2/AWG18; 600VAC Above	 Tube-shaped cold-pressed terminal E1512	0.75mm^2/AWG18; Above 600VAC	0.28mm^2/AWG22-0.75mm^2/AWG18; Above 100VAC
Three-phase 220V	750W	About 1.3KVA						
Three-phase 220V	1.5KW	About 2.3KVA	2.0mm^2/AWG14; Above 600VAC				2.0mm^2/AWG14; Above 600VAC	0.75mm^2/AWG18; Above 100VAC
Three-phase 220V	2.2KW	About 3.3KVA						
Three-phase 220V	3KW	About 4.5KVA	3.5mm^2/AWG14; Above 600VAC				3.5mm^2/AWG12; Above 600VAC	0.75mm^2/AWG18; Above 100VAC
Three-phase 220V	5KW	About 7.5KVA						

2.2 System composition and wiring

2.2.1 Key points of wiring

1. Wiring works shall be operated by electrical engineering specialists.
2. Please do not connect the power supply before the completion of wiring works, to avoid electric shock accident.
3. Please note that the power connector has high voltage to avoid electric shock.
4. As regards command input and wiring to encoder, please use the designated cable. Please choose the shortest route as far as possible.
5. For earthing wiring, use thick wire as far as possible (above 2.0mm^2):
(1) Please adopt earthing mode of above type D as recommended (earthing resistance value < 100Ω);
(2) It must be single point grounding;
(3) For mutual insulation between a servo motor and a machine, please directly earth the servo motor.
6. Do not bend or tension wires:
(1) The core wire of signal cable is only 0.2mm or 0.3mm in size, which is very thin, so please use it with caution.
7. To deal with radio frequency interference, please use a noise filter:
(1) When used in the vicinity of dwellings or worrying about exposure to radio frequency interference, please insert a noise filter on the input side of power cord;
(2) Servo unit is an industrial equipment, so no countermeasures are taken against radio frequency interference.
8. To prevent malfunction caused by noises, please take the following effective measures:
(1) Please configure input command equipment and noise filter in the vicinity of servo unit as far as possible;
(2) Make sure to install surge suppressors on relay, solenoid and electromagnetic contractor coils;
(3) During wiring, please separate power cords (power cord, servo motor wiring and other strong power circuits) from signal line (encoder wire and network cable), and keep a distance of above 30cm. Do not lead them through the same conduit, or bundle them together.
(4) Do not share the same power source with electric welder or electric discharge machine. In case of a high-frequency generator in the vicinity, even if they do not share the same power source, please still insert a noise filter on the input side of power cord.
9. Use wiring circuit breaker (QF) or fuse to protect power cords:
(1) This servo driver is directly connected to industrial power cords. To prevent crossing electric shock accidents in a servo system, please make sure to use wiring circuit breaker (QF) or fuse.
10. Servo driver has no built-in earthing protection circuit:
(1) To constitute a safer system, please configure a residual-current circuit breaker shared by overload and short-circuit protection, or a residual-current circuit breaker that is equipped with wiring circuit breaker and dedicated to earth wire protection.
11. Servo driver has no power efficiency improvement circuit:
(1) In order to reduce the interference to the power grid, it is necessary to work with a suitable reactor.

Single-phase 220V:

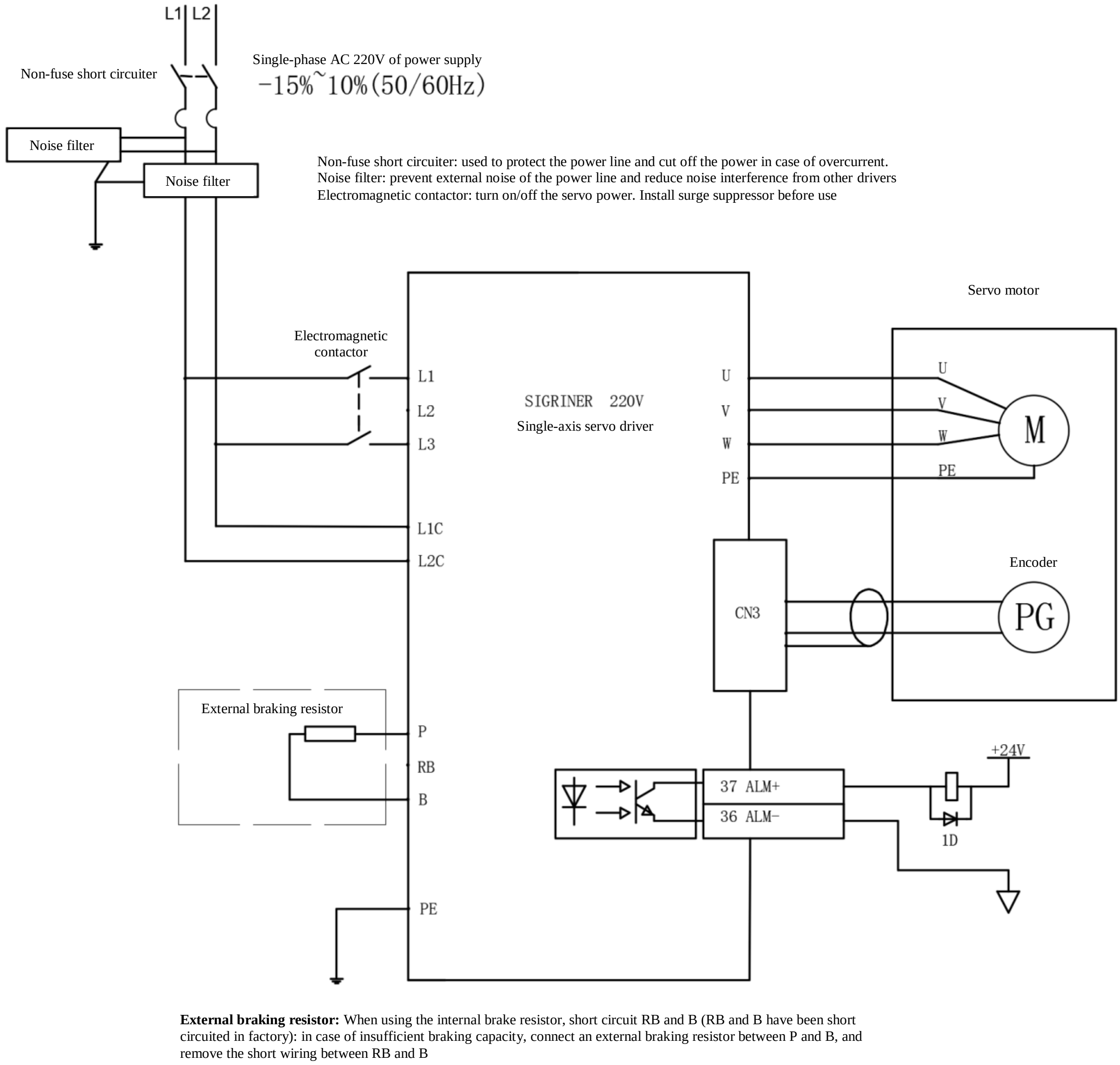
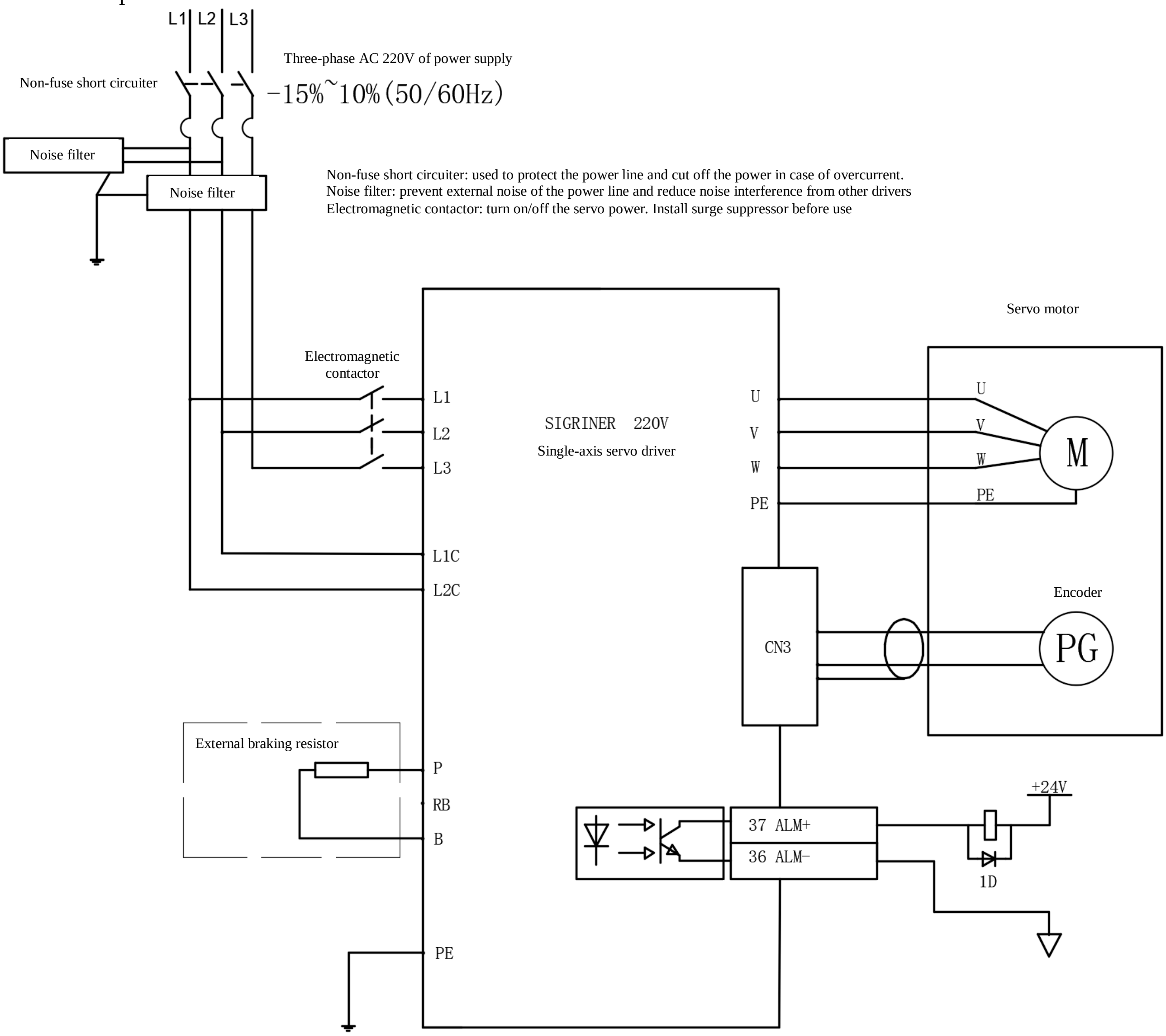


Fig. 2.2.1-1 Single-phase 220V wiring diagram

Three-phase 220V:



External braking resistor: When using the internal brake resistor, short circuit RB and B (RB and B have been short circuited in factory): in case of insufficient braking capacity, connect an external braking resistor between P and B, and remove the short wiring between RB and B

Fig. 2.2.1-2 Three-phase 220V wiring diagram

Wiring method:

1. Strip the insulating layer of the wire. Please refer to the dimensions in the following figure

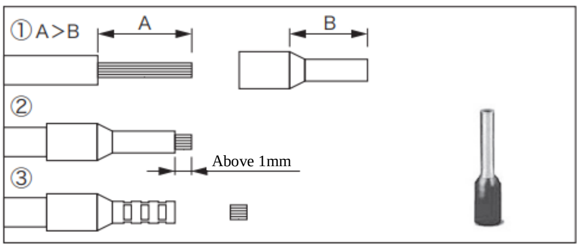
During wiring, please be sure to follow the example below to install the terminal.

Example: Tube-shaped cold-pressed terminal (E1512)

(1) Strip the insulating layer at the front end of the wire to expose the conductor part of the wire (1-2mm longer than the section B of the tube-shaped cold-pressed terminal).

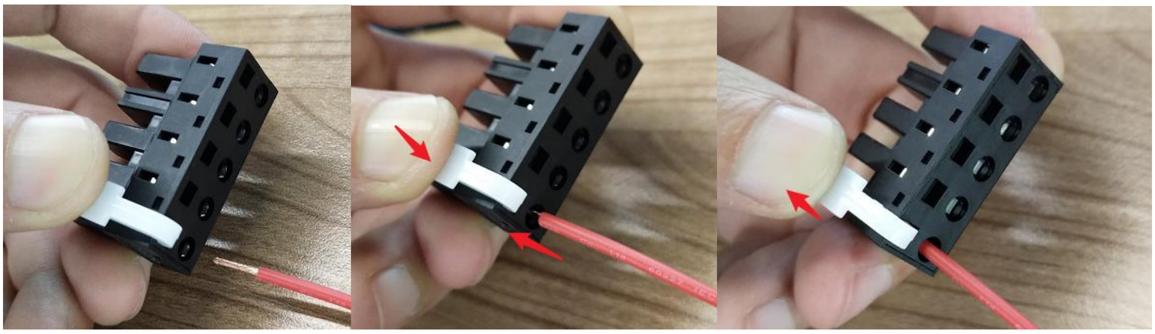
(2) Insert the wire into the tube-shaped cold-pressed terminal, and press with the matching crimping pliers.

(3) After pressing, remove the conductor part of the wire that exposes the tube-shaped cold-pressed terminal and make it flush with the front end of the tube-shaped cold-pressed terminal.



Insert the wire pressed into the tube-shaped cold-pressed terminal into the special connecting terminal. Use the attached mounting

compression rod.



1. Press down hard the mounting compression rod   2. Insert the wire into the mounting hole   3. Loosen themounting compression rod

Note:

(1) Operate in the opposite direction to take out the wire.

(2) Take good care of the mounting compression rod after installation to prevent from loss.

2.2.2 Driver wiring diagram

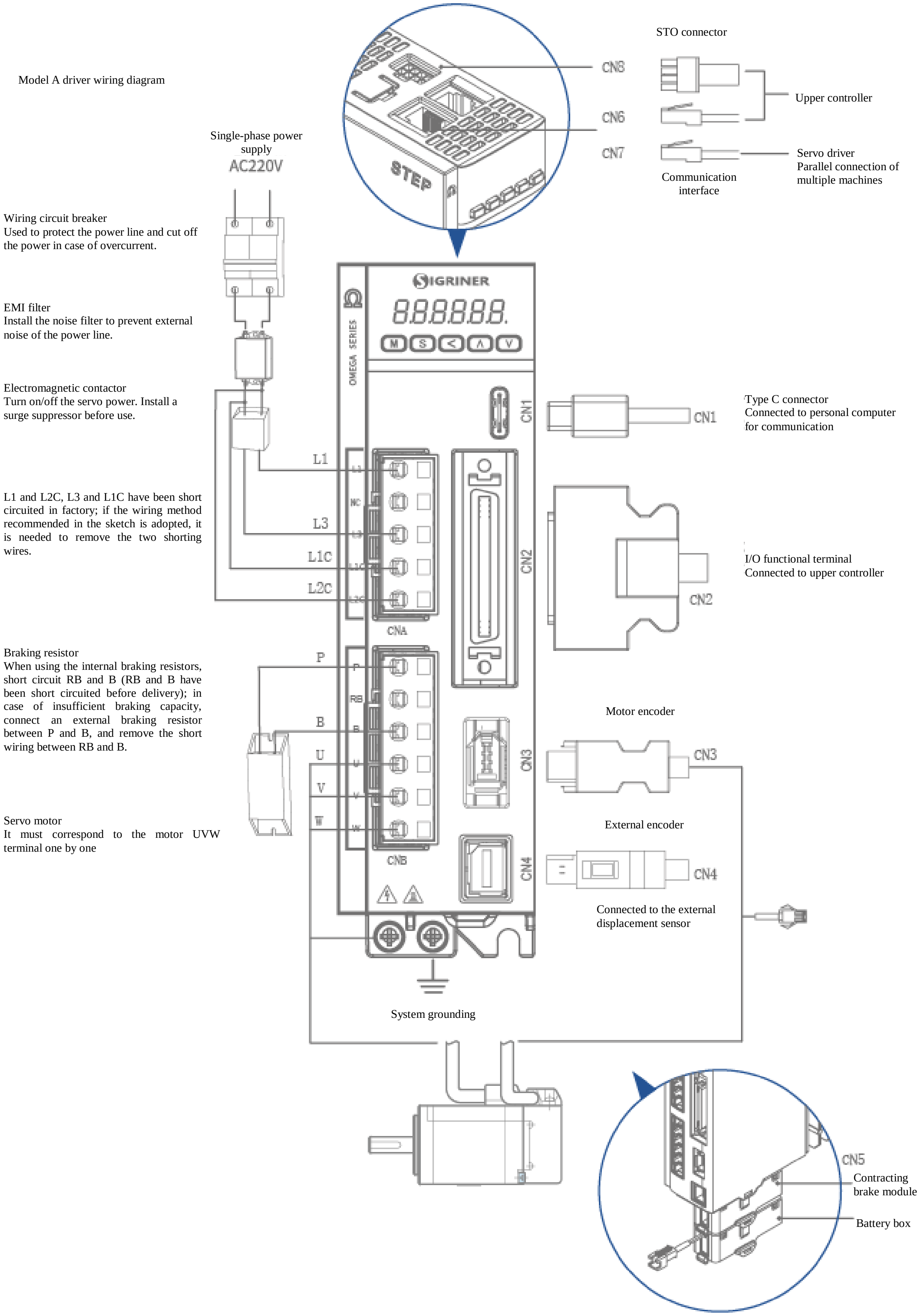


Figure 2.2.2-1 Wiring diagram of type A driver

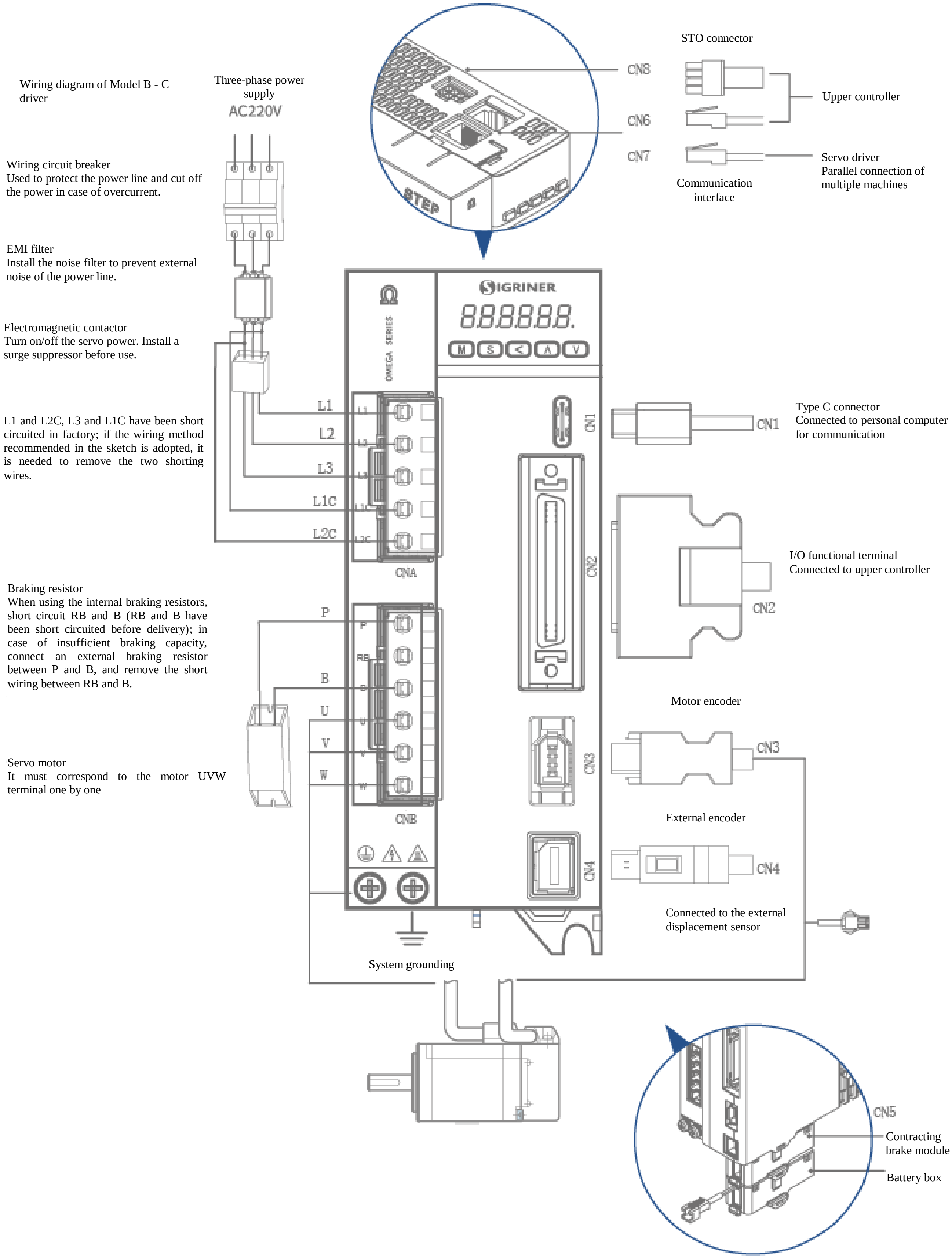


Figure 2.2.2-1 Wiring diagram of Model B - C driver

2.2.3 Specifications of OM1 motor connector

1. 50W - 1.0kW (□80), excluding 850W

(1) 17-bit incremental encoder
Encoder connector
Manufacturer: TycoElectronicsAMP
Housing: 172168-1
Terminal: 170359-1or170363-1
Pin connection

Pin number	Color	Signal
1	—	NC
2	White (red dot mark)	PS
3	White (black dot mark)	$\overline{PS}$
4	Orange (red dot mark)	E5V
5	Orange (black dot mark)	E0V
6	Black	FG (shielded)

(2) 17-bit absolute encoder
Encoder connector
Manufacturer: TycoElectronicsAMP
Housing: 172169-1
Terminal: 170359-1or170363-1
Pin connection

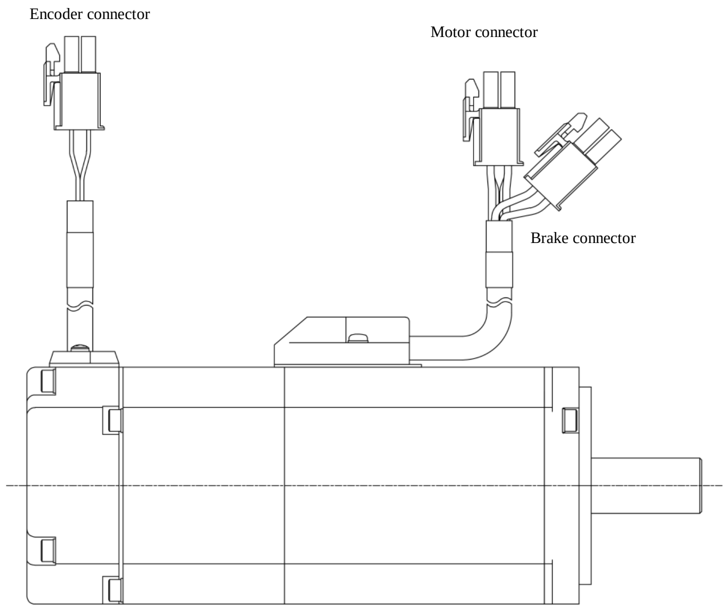
Pin number	Color	Signal
1	Brown	BAT+
2	--	NC
3	Black (heat-shrinkable tubing)	FG (shielded)
4	White (red dot mark)	PS
5	White (black dot mark)	$\overline{PS}$
6	--	NC
7	Orange (red dot mark)	E5V
8	Orange (black dot mark)	E0V/ BAT-
9	--	NC

(3) Motor connector
Manufacturer: TycoElectronicsAMP
Housing: 172167-1
Terminal: 170360-1or170364-1
Pin connection

Pin number	Color	Signal
1	Red	U
2	White	V
3	Black	W
4	Green	Ground wire

(4) Brake connector
Manufacturer: TycoElectronicsAMP
Housing: 172165-1
Terminal: 170360-1or170364-1
Pin connection

Pin number	Color	Signal
1	Yellow	BRK+
2	Blue	BRK-



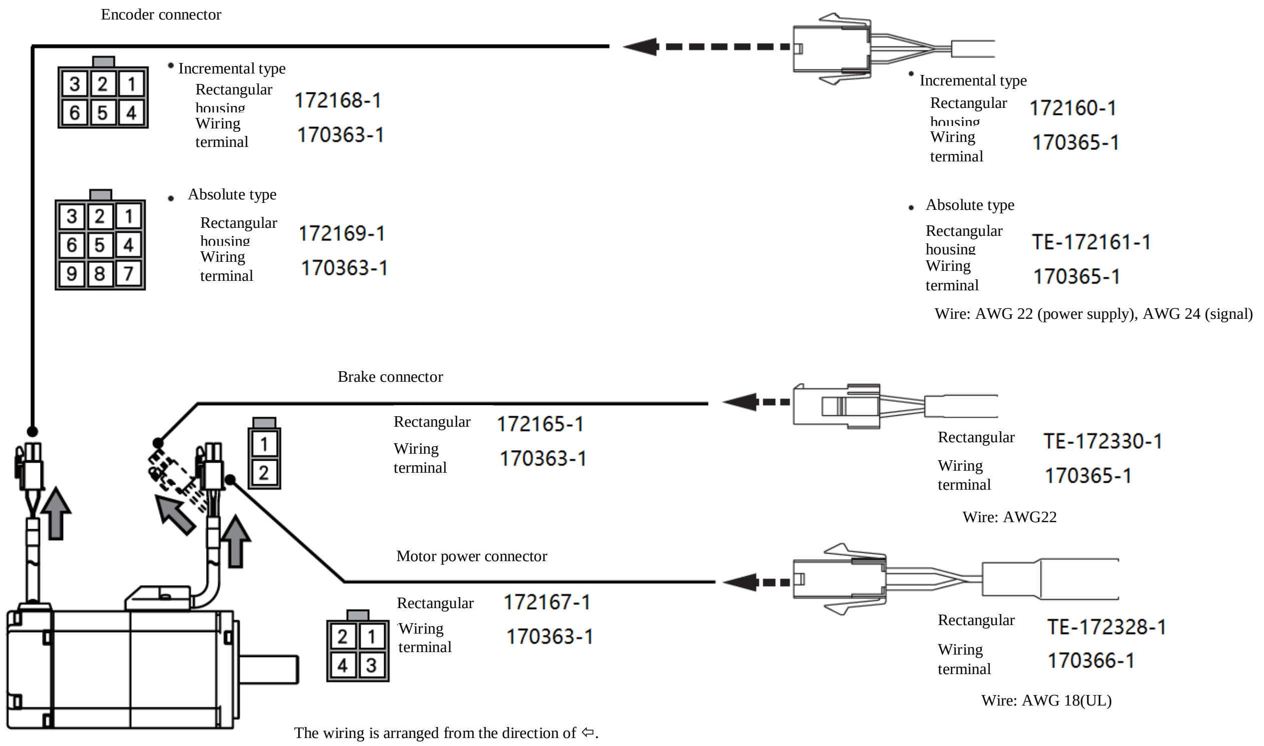
(5) Motor/encoder connector

	17-bit incremental encoder	17-bit absolute encoder
Motor model	OM□1□□□□□□N**	OM□1□□□□□□A**
Housing	172160-1	172161-1
Socket	170361-1 or 170365-1 770834-1 or 794058-1	170361-1 or 170365-1 770834-1 or 794058-1

	17-bit incremental encoder	17-bit absolute encoder
Housing	172159-1	172233-1
Socket	170362-1 or 170366-1	170362-1 or 170366-1

1) Use GND as the reference unit of external capacitor and battery.
2) Please do not connect to IC pin in any manner.

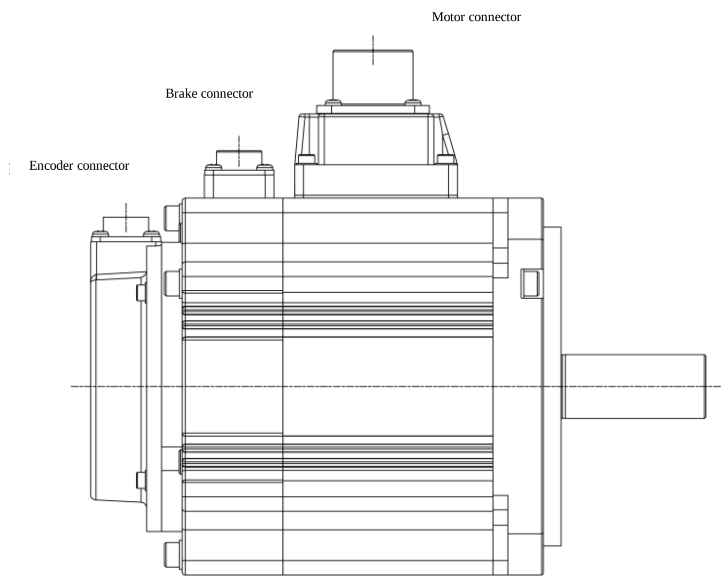
(6) Motor wiring diagram



The wiring is arranged from the direction of ⇦.

Name	Pin NO.	Signal name	Content
Motor power connector	1	U	Motor U-phase
	2	V	Motor V-phase
	3	W	Motor W-phase
	4	Ground wire	Motor housing grounding
Brake connector	1	BRK+	Brake power DC24V
	2	BRK-	Brake power GND
Encoder connector (incremental type)	1	NC	Please do not connect any equipment
	2	PS	Encoder signal data +
	3	$\overline{PS}$	Encoder signal data -
	4	E5V	Encoder power supply +5V
	5	E0V	Encoder power supply
	6	FG (shielded)	Shield
Encoder connector (absolute type)	1	BAT+	Battery BAT+
	2	NC	NC
	3	FG (shielded)	Shield
	4	PS	Encoder signal data +
	5	$\overline{PS}$	Encoder signal data -
	6	NC	Please do not connect any equipment
	7	E5V	Encoder power supply +5V
	8	E0V/BAT-	Encoder power supply/battery BAT-
	9	NC	Please do not connect any equipment

2. 850W - 2.0kW, excluding 1.0kW (☐80)



(1) Brake and motor connector
Manufacturer: DDK
Type: CM10-R2P-D (D7)
Pin connection

Pin number	Color	Signal
1	Yellow	BRK+
2	Blue	BRK-

Manufacturer: JAE
Type: JL04V-2E18-10PE-B-R
Pin connection

Pin number	Color	Signal
1	Red	U
2	White	V
3	Black	W
4	Green	Ground wire

(2) Encoder connector
Manufacturer: DDK
Type: CM10-R10P-D (D7)
Pin connection

Encoder	N17bit incremental type	A17bit absolute value
Pin number	Signal	Signal
1	E5V	E5V
2	E0V	E0V
3	NC	NC
4	NC	BAT+
5	PS	PS
6	$\overline{PS}$	$\overline{PS}$
7	NC	NC
8	NC	NC
9	NC	BAT-
10	FG (shielded)	FG (shielded)

(3) Recommended connector

	17-bit incremental encoder	17-bit absolute encoder
Motor model	OM□1□□□□□□N**	OM□1□□□□□□A**

Manufacturer	DDK
Housing	CM10-AP10S-□-D (L shape) CM10-SP10S-□-D (straight)
Contact	CM10-#22SC (△△) (D8)-100 bulk part contact crimping type, welding type CM10-#22SC (△△) (D8)-100 reel crimping type

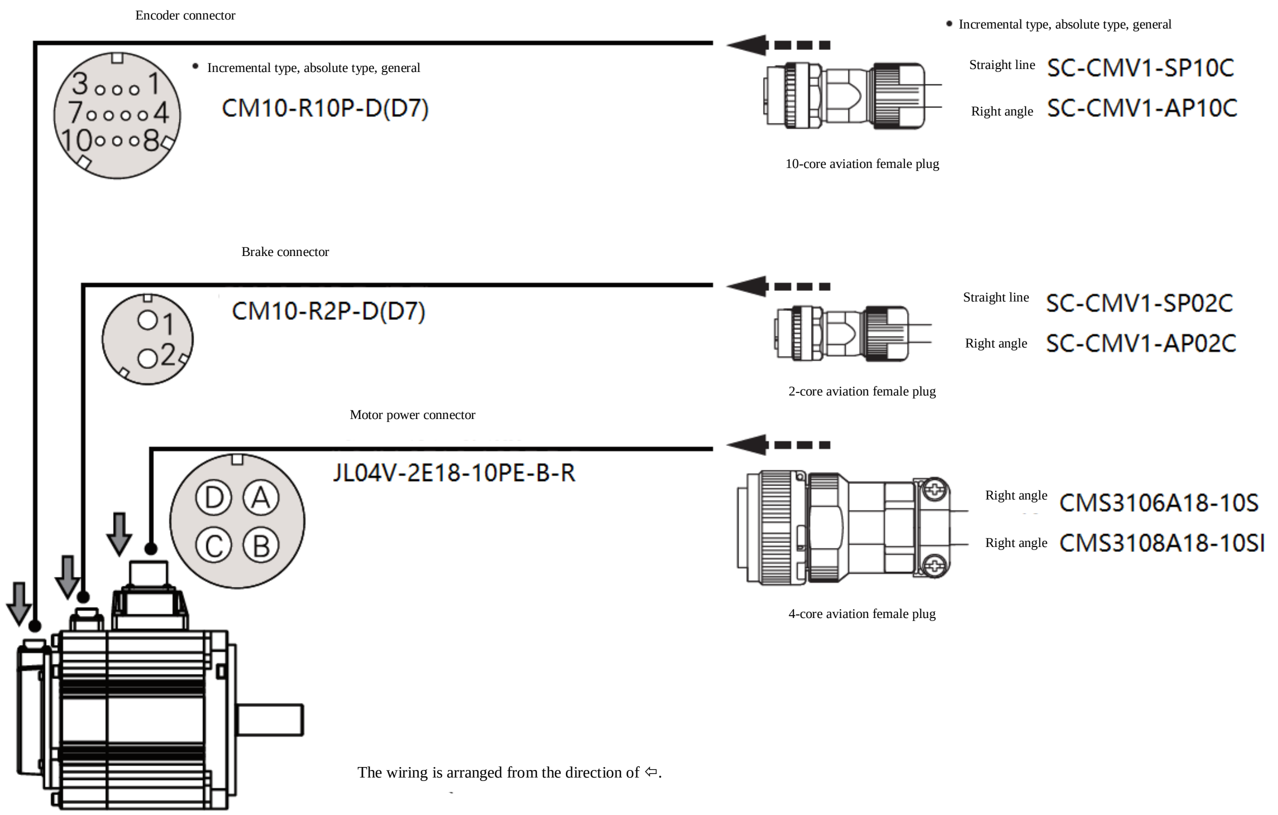
	Motor connector	Brake connector
Manufacturer	JAE	DDK
Housing	JL04V-6A18-10SE-EB-R (straight line type) JL04V-8A18-10SE-EB-R (right angle type)	CM10-SP2S-□-D (straight line type) CM10-AP2S-□-D (right angle type)
Contact		CM10-#22S(C3)(D8)-100 (crimping) (Bulk part contact crimping type) CM10-#22S(S2)(D8)-100 (welding) (Bulk part contact welding type) CM10-#22S(D3)(D8)-4000 (reel crimping)

1) Notes for connector (DDK system)

2) Box (□) represents the changed value, depending on the outer diameter of cable.

3) Triangle (△) represents the changed value, depending on the size of cable core.

(4) Motor wiring diagram

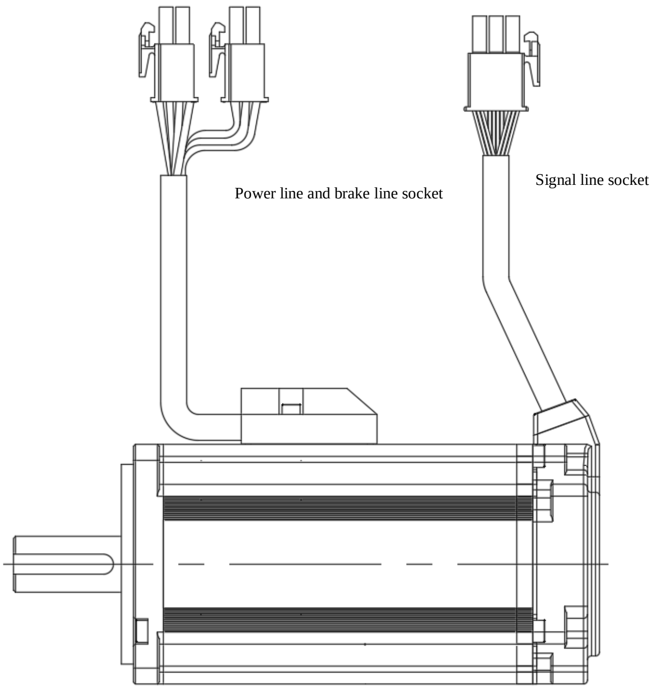


Name	Pin NO.	Signal name	Content
Motor power connector	A	U	Motor U-phase
	B	V	Motor V-phase
	C	W	Motor W-phase
	D	Ground wire	Motor housing grounding
Brake connector	1	BRK+	Brake power DC24V
	2	BRK-	Brake power GND
Encoder connector (incremental type)	1	E5V	Encoder power supply +5V
	2	E0V	Encoder power supply

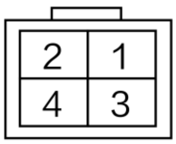
	3	NC	Please do not connect any equipment
	4	NC	Please do not connect any equipment
	5	PS	Encoder signal data +
	6	$\overline{PS}$	Encoder signal data -
	7	NC	Please do not connect any equipment
	8	NC	Please do not connect any equipment
	9	NC	Please do not connect any equipment
	10	FG (shielded)	Shield
Encoder connector (absolute type)	1	E5V	Encoder power supply +5V
	2	E0V	Encoder power supply
	3	NC	Please do not connect any equipment
	4	BAT+	Battery BAT+
	5	PS	Encoder signal data +
	6	$\overline{PS}$	Encoder signal data -
	7	NC	Please do not connect any equipment
	8	NC	Please do not connect any equipment
	9	BAT-	Battery BAT-
	10	FG (shielded)	Shield

2.2.4 Specifications of OM2 motor connector

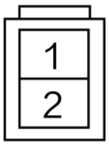
1. OM2 (plug) 100W-1.0kW (□80), excluding 850W motor connector:



(1) Power and brake wiring terminal

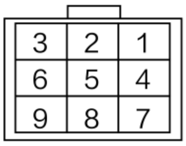


PIN No.	Color	Purpose
1	Red	Phase U
2	White	Phase V
3	Black	Phase W
4	Green	Ground wire



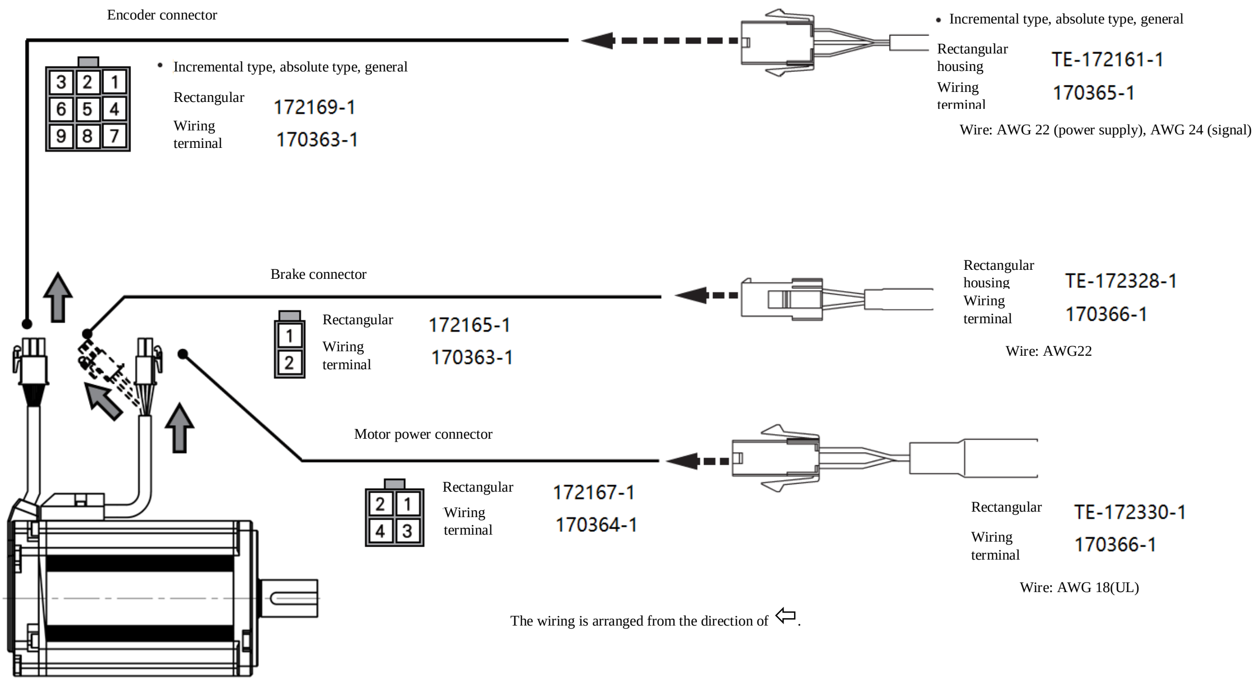
PIN No.	Color	Purpose
1	Yellow	Brake
2	Blue	Brake

(2) 9-core wiring terminal of encoder



PIN No.	Color	Purpose
1	Brown	BAT+
2	Black	BAT-
3	Black (heat-shrinkable tubing)	FG (shielded)
4	White (red dot mark)	PS
5	White (black dot mark)	$\overline{PS}$
6	--	NC
7	Orange (red dot mark)	E5V
8	Orange (black dot mark)	E0V
9	--	NC

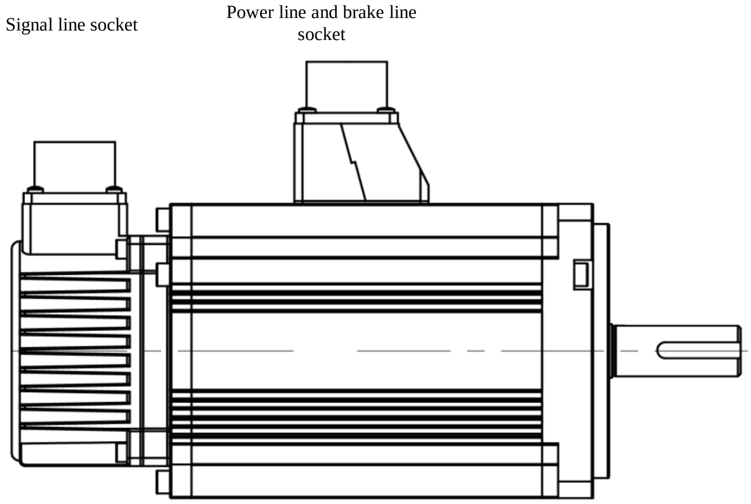
(3) Motor wiring diagram



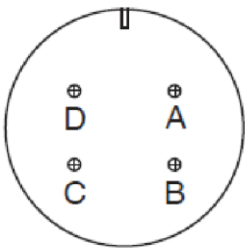
Name	Pin NO.	Signal name	Content
Motor power connector	1	U	Motor U-phase
	2	V	Motor V-phase
	3	W	Motor W-phase
	4	Ground wire	Motor housing grounding

Brake connector	1	BRK	Braking 24V
	2	BRK	Braking 24V
Encoder connector	1	BAT+	Battery BAT+
	2	BAT-	Battery BAT-
	3	FG (shielded)	Shield
	4	PS	Encoder signal data +
	5	$\overline{PS}$	Encoder signal data -
	6	NC	Please do not connect any equipment
	7	E5V	Encoder power supply +5V
	8	E0V	Encoder power supply
	9	NC	Please do not connect any equipment

2.OM2850W - 3.0kW (□80), excluding 1.0kW (□80) motor connector:

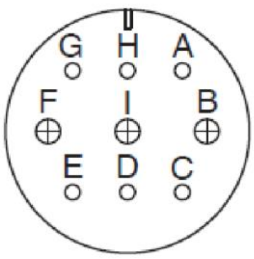


(1) 4-core power socket



Socket pin	Color	Pin definition
A	Red	U
B	White	V
C	Brown	W
D	Green	Ground wire

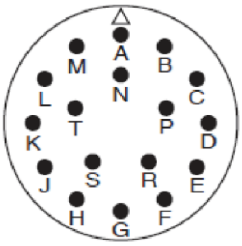
(2) Power and brake 9-core braking aviation plug



Socket pin	Color	Pin definition
G	Yellow	24V for braking, NC for no braking
H	Blue	24V for braking, NC for no braking
A	--	NC

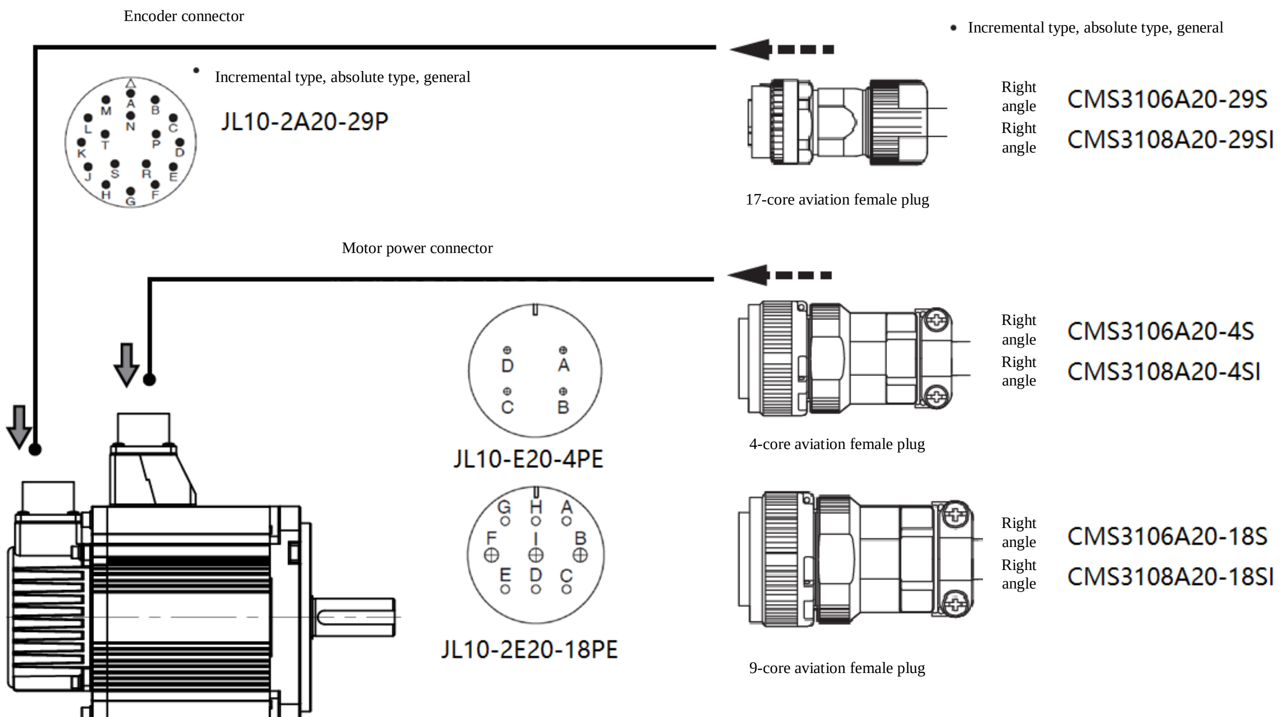
F	Red	U
I	White	V
B	Black	W
E	Green	Ground wire
D	Yellowish green	PE
C	--	NC

(3) 17-core signal aviation plug



Socket pin	Color	Pin definition
A	--	NC
B	--	NC
C	--	NC
D	--	NC
E	--	NC
F	--	NC
G	Orange (black dot)	E0V
H	Orange (red dot)	E5V
J	Black (heat-shrinkable tubing)	FG (shielded)
K	White (red dot mark)	PS
L	White (black dot mark)	$\overline{PS}$
M	--	NC
N	--	NC
P	--	NC
R	--	NC
S	Black	Battery BAT-
T	Brown	Battery BAT+

(4) Motor wiring diagram



The wiring is arranged from the direction of ⇦.

Name	Pin NO.	Signal name	Content
Motor power connector (4 cores)	A	U	Motor U-phase
	B	V	Motor V-phase
	C	W	Motor W-phase
	D	Ground wire	Motor housing grounding
Motor power connector (9 cores)	G	BRK	24V for braking, not connected for no braking.
	H	BRK	24V for braking, not connected for no braking.
	A	NC	Please do not connect any equipment
	F	U	Motor U-phase
	I	V	Motor V-phase
	B	W	Motor W-phase
	E	Ground wire	Motor housing grounding
	D	PE	Ground wire
	C	NC	Please do not connect any equipment
Encoder connector	A	NC	Please do not connect any equipment
	B	NC	Please do not connect any equipment
	C	NC	Please do not connect any equipment
	D	NC	Please do not connect any equipment
	E	NC	Please do not connect any equipment
	F	NC	Please do not connect any equipment
	G	E0V	Encoder power supply
	H	E5V	Encoder power supply +5V
	J	FG (shielded)	Shield
	K	PS	Encoder signal data +
	L	$\overline{PS}$	Encoder signal data -
	M	NC	Please do not connect any equipment
	N	NC	Please do not connect any equipment
	P	NC	Please do not connect any equipment
	R	NC	Please do not connect any equipment
	S	BAT-	Battery BAT-
	T	BAT+	Battery BAT+

2.3 Wiring of driver connector

2.3.1 Wiring of connector CN1

The wiring of connector CN1 is connected to computer USB or WIFI module. The parameter settings can be changed and monitored.

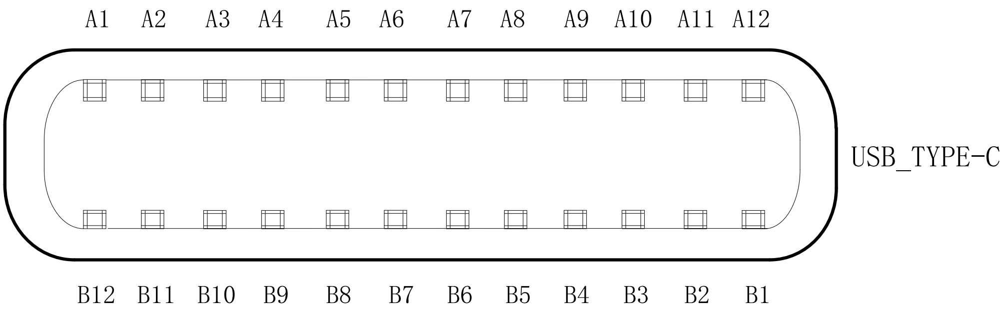


Figure 2.3.1-1 CN1 interface

Name	Signs	Connector pin No.	Content
USB_TYPE-C	GND	A1, B12, A12, B1	Connected to the ground wire of control circuit.
	VBUS	A4, B9, A9, B4	Used in with computer for communication.
	D-	A7, B7	
	D+	A6, B6	
	TX+	A2, B2	Serial port communication, switched to WIFI communication module externally.
	TX-	A3, B3	
	RX+	A11, B11	
	RX-	A10, B10	

TIPS Note: for the driver-side connector, please use USB-Type C (commercially available) cable. When there is no cable with anti-noise magnetic ring, please install noise filter ZCAT3035-1330(-BK) for signal line at both ends of the cable.

2.3.2 Wiring of connector CN2

CN2 interface on the controller panel is the connection interface of digital and analog input and output of drivers and communication signals. CN2 is SM50J-core socket, and the following is the agram of panel interface:

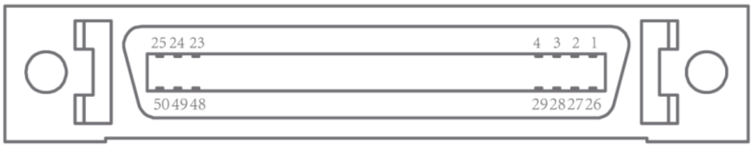


Figure 2.3.2-1 CN2 interface

I/O functional terminal of Ω6 series driver				
Terminal number	Definition	Symbol	Signal name	Function description
1	OPC1	OPC1	Low-speed pulse input signal (12-24V level)	Photocoupler input, pulse (≤500Khz) input signal, the external level that can be connected is 12-24V.
2	OPC2	OPC2	Low-speed pulse direction control (12-24V level)	Photocoupler input, pulse (≤500Khz) input signal, the external level that can be connected is 12-24V.
3	PULS1	PULS1	Low-speed pulse input signal (5V level)	Photocoupler input, pulse (≤500Khz) input signal, The external level that can be connected to this pin is 5V.
4	PULS2	PULS2	Low-speed pulse input circuit signal (GND level)	This pin is connected to external PLC GND signal.
5	SIGN1	SIGN1	Low-speed pulse direction control (5V level)	Photocoupler input, pulse (≤500Khz) input signal, the external level that can be connected is 12-24V.
6	SIGN2	SIGN2	Low-speed pulse direction control circuit (GND level)	This pin can be connected to external PLC GND signal.
7	COM+	COM+	Common terminal of optocoupler input	Analog monitor input, common terminal of optocoupler input
8	NOT	SI1	Negative drive inhibiting input	Digital input, negative drive inhibiting input This pin can support high-speed digital signal input up to 1Mhz
9	POT	SI2	Positive drive inhibiting input	Digital input, positive drive inhibiting input
10	BRKOFF-	SO1-	External brake release signal -	Digital output, external brake release negative signal
11	BRKOFF+	SO1+	External brake release signal +	Digital output, external brake release positive signal
12	ZSP	SO5	Zero speed detection signal	Digital output signal, zero speed detection signal This pin can support high-speed digital signal output up to 1Mhz
13	GND	GND	Ground signal	High-speed pulse input and analog ground signal
14	SPR/TRQR/ SPL	AI1	Analog input	Analog input 1
15	GND	GND	Ground signal	High-speed pulse input and analog ground signal

16	P-ATL/ TFQR	AI2	Analog input	Analog input 2
17	GND	GND	Ground signal	High-speed command input and analog ground signal
18	N-ATL	AI3	Analog input	Analog input 3
19	CZ	CZ	Encoder phase Z signal	Open collector output, encoder phase Z signal
20	NC.	NC.	Invalid	Please do not connect any equipment
21	OA+	OA+	Positive terminal of phase A	Positive terminal of phase A pulse frequency division output
22	OA-	OA-	Negative terminal of phase A	Negative terminal of phase A pulse frequency division output
23	OZ+	OZ+	Positive terminal of phase Z	Positive terminal of phase Z pulse frequency division output
24	OZ-	OZ-	Negative terminal of phase Z	Negative terminal of phase Z pulse frequency division output
25	GND	GND	Ground signal	High-speed pulse input and analog ground signal
26	VS-SEL1	SI3	Vibration control switching input 1	Digital input, vibration control switching input 1
27	GAIN	SI4	Gain switching input	Digital input, gain switching input
28	DIV1	SI5	Command frequency division and multiplication switching input 1	Digital input, command frequency division and multiplication switching input 1 This pin can support high-speed digital signal input up to 1MH
29	SRV-ON	SI6	Servo enabling input	Digital input, servo enabling input
30	CL	SI7	Deviation counter resetting input	Digital input, deviation counter resetting input
31	A-CLR	SI8	Alarm clearing	Digital input, alarm clearing
32	C-MODE	SI9	Control mode switching input	Digital input, control mode switching input
33	INH	SI10	Command pulse inhibiting input	Digital input, command pulse inhibiting input This pin can support high-speed digital signal input up to 1Mhz
34	S-RDY-	SO2-	Negative terminal of servo ready output	Digital output, negative terminal of servo ready output
35	S-RDY+	SO2+	Positive terminal of servo ready output	Digital output, positive terminal of servo ready output
36	ALM-	SO3-	Negative terminalof servo alarm output	Digital output, negative terminal of servo alarm output
37	ALM+	SO3+	Positive terminal of servo alarm output	Digital output, positive terminal of servo alarm output
38	INP-	SO4-	Negative terminal of positioning completion	Digital output, negative terminal of positioning completion

39	INP+	SO4+	Positive terminal of positioning completion	Digital output, positive terminal of positioning completion
40	TLC	S06	Signal output in torque limit	Digital output, signal output in torque limit This pin can supporthigh-speed digital signal output up to 1MHz
41	COM-	COM-	Common terminal of optocoupler input	Analog monitor input, common terminal of optocoupler input
42	IM	A02	Torque analog signal output	Analog monitor output, torque analog signal output
43	SP	S01	Speed analog signal output	Analog monitor output, speed analog signal output
44	PULSH1	PULSH1	Command pulse input 1	Position command pulse input, with maximum frequency of 16Mpulse/s (differential input). Pulse array interface for long line driver (please use this interface at the frequency of 500kpulse/s - 4Mpulse/s)
45	PULSH2	PULSH2	Command pulse input 2	
46	SIGNH1	SIGNH1	Command symbol input 1	
47	SIGNH2	SIGNH2	Command symbol input 2	
48	OB+	OB+	Positive terminal of phase B	Positive terminal of phase B pulse frequency division output
49	OB-	OB-	Negative terminal of phase B	Negative terminal of phase B pulse frequency division output
50	FG	FG	Housing grounding	Connected to the grounding terminal within the servo driver

Note: please be sure to use the shield cable for CN2 wiring, and ground the shield terminal to improve the immunity.

2.3.3 Wiring of connector CN3

CN3 is the connected wiring of absolute encoder, and the interface is defined as follows.

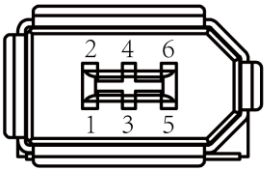


Figure 2.3.3-1 CN3 interface

Name	Signs	Connector pin No.	Content
Power supply of encoder	E5V	1	Encoder power supply +5V
	E0V	2	Encoder power supply 0V
--	NC	3	Please do not connect any equipment
--	NC	4	Please do not connect any equipment
Encoder RS485	PS	5	Encoder communication signal +
	$\overline{PS}$	6	Encoder communication signal +
Housing grounding	FG	Housing	Connected to the grounding terminal within the servo driver

Note: please be sure to use the shield cable for CN3 wiring, and ground the shield terminal to

improve the immunity.

2.3.4 Wiring of connector CN4

CN4 provides the connection to external displacement sensor, and the interface is defined as follows.

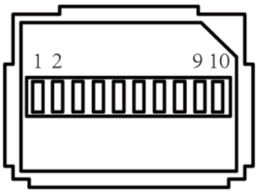


Figure 2.3.4-1 CN4 interface

Application	Signs	Connector pin No.	Content
Power output	EX5V	1	Encoder power supply +5V
	EX0V	2	Encoder power supply 0V
--	NC	3	Please do not connect any equipment
--	NC	4	Please do not connect any equipment
Encoder signal input of Phases A, B and Z	EXA	5	Parallel signal Receiving signal Corresponding speed: 16Mpulse/s (after 4 octave)
	$\overline{EXA}$	6	
	EXB	7	
	$\overline{EXB}$	8	
	EXZ	9	
	$\overline{EXZ}$	10	
Housing grounding	FG	Housing	Connected to the grounding terminal within the driver.

Note: please be sure to use the shield cable for CN4 wiring, and ground the shield terminal to improve the immunity.

2.3.5 Wiring of connector CN6/CN7

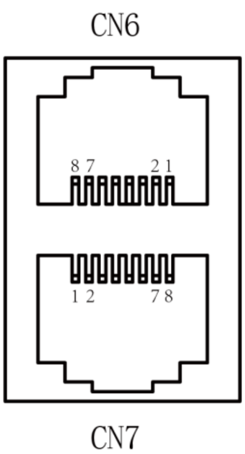


Figure 2.3.5-1 CN6/CN7 interface

It is possible to realize the communication connection with PC, PLC and driver via CN6 and CN7 interfaces. In addition, CN6 and CN7 can provide the input and output of gantry synchronous function signal. The pins of CN6 and CN7 are defined as follows.

CN6 pin function description:

Name	Signs	Connector pin No.	Content
Synchronous signal input	SYNC0_RX+	1	Differential signal of gantry synchronous function input
	SYNC0_RX-	2	
--	NC	3	Please do not connect any equipment

RS485 signal	RS485-	4	RS485 receiving and sending signal
	RS485+	5	
--	NC	6	Please do not connect any equipment
--	NC	7	Please do not connect any equipment
Signal grounding	485_GND	8	RS485 isolation signal ground

CN7 pin function description:

Name	Signs	Connector pin No.	Content
Synchronous signal output	SYNC0_TX+	1	Differential signal of gantry synchronous function output
	SYNC0_TX-	2	
Impedance adapting	RS485_X-	3	Used for adaptive connection with the built-in terminal resistance of the driver
RS485 signal	RS485-	4	RS485 receiving and sending signal
	RS485+	5	
Impedance adapting	RS485_X+	6	Used for adaptive connection with the built-in terminal resistance of the driver
--	NC	7	Please do not connect any equipment
Signal grounding	RS485_GND	8	RS485 signal ground

TIPS Note:

1. Terminal resistance of RS485 is matched, no need to be increased additionally. The following two proposals are provided.

Self-made proposal: pin 3 and pin 4 of CN7 interface of the driver at the last network node are short circuited, and pin 5 and pin 6 are shorted to complete the automatic connection of terminal resistance.

Accessory proposal: matching RJ45 short circuited crystal head accessories are provided.

2. The synchronous connection mode of gantry can be connected by standard category 5 or super category 5 Ethernet cable, and no customized cable is required.

2.3.6 Wiring of connector CN8

The safety function shall be used after connecting with the upper controller. Standard safety bypass socket is provided before delivery. Please do not unplug it without using the safety function. To use the safety function, please unplug the attached safety bypass plug and connect it with the upper controller. Please refer to the following wiring of STO safety bypass plug.

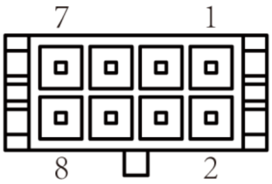


Figure 2.3.6-1 CN8 interface

Name	Signs	Connector pin No.	Content
-12V	--	1	The power supply used by STO safety bypass, inside the driver.
+12V	--	2	
Safety input 1	SF1-	3	STO request input signal. Two sets of system independent circuits, turn off the driving signal of the power module and cut off the power supply.
	SF1+	4	
Safety input 2	SF2-	5	
	SF2+	6	
EDM output	EDM-	7	Monitoring output signal of STO safety function failure
	EDM+	8	

Standard safety bypass plug (internal wiring) for driver, the wiring when safety circuit is not constituted:

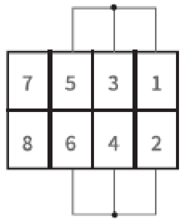


Figure 2.3.6-2 Safety bypass plug

2.3.7 Wiring of connector CNA/CNB

CNA wiring:
CNA provides the interface between driver power supply and driver control power supply.

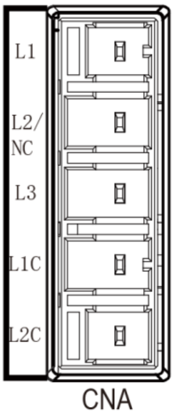


Figure 2.3.7-1 CNA interface

Name	Signs	Connector pin No.	Content
L1	L1	1	Single-phase/three-phase power L1 connector
L2/NC	L2/NC	2	Three-phase power L2 connector (NC for type A connector)
L3	L3	3	Single-phase/three-phase power L3 connector
L1C	L1C	4	Single-phase input of control circuit
L2C	L2C	5	Single-phase input of control circuit

CNB wiring:
CNB provides the interface between driver power supply and driver control power supply.

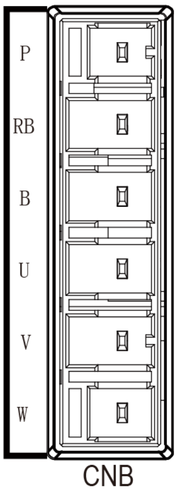


Figure 2.3.7-2 CNB interface

Name	Signs	Connector pin No.	Content
P	P	1	Braking resistor positive
RB	RB	2	Internal braking resistor, if an internal braking resistor is needed, RB and B should be short

			circuited .
B	B	3	External braking resistor interface
U	U	4	Motor phase U output
V	V	5	Motor phase V output
W	W	6	Motor phase W output

The power,control,motor and brake resistance interfaces of type D driverare nut crimped.Refer to CAN and CNB for the definition of interfaces.

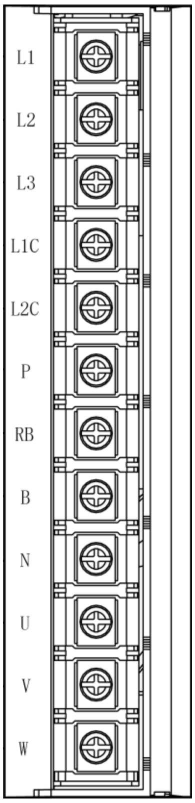


Figure 2.3.7-2 Type D driver power,control,motor and brake resistance interface

2.4 Timing diagram

2.4.1 When power is switched on

- When power is switched on (the timing of receiving the servo enable on signal)

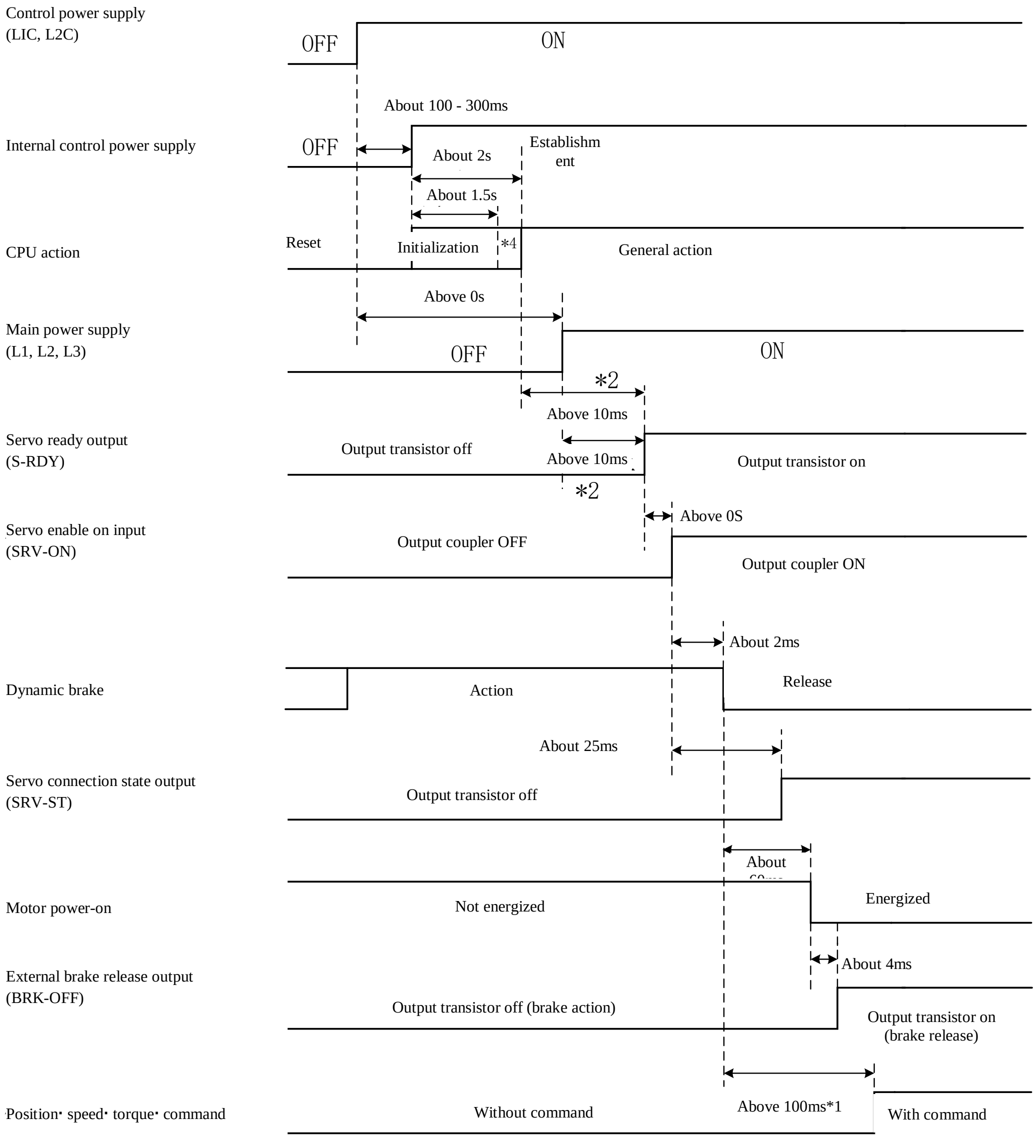


Figure 2.4.1-1 Timing of enabling signal

Note:

The figure above shows the timing from connecting AC power to inputting the command.

Please input the servo connection signal, position, speed and torque command according to the time sequence in the figure above.

1. In this interval, although the servo enable on signal (SRV-ON) has been input, the command has not been processed.

2. S-RDY output, switched on after the initialization of CPU is completed and the main power supply is switched on.

3. After establishment of internal control power supply, the protection function starts after the CPU initialization starts for approximately 1.5s. Please design in a manner that before the protection function

starts, all the output and input signals connected to the driver (especially the positive/negative drive inhibiting input, external displacement sensor input, etc.) are safe and reliable.
The waiting time after connection of power supply can be set via Pr6.18 “waiting time of connecting power supply”.
4. Pleas note that the servo connection state output (SRV-ST) means that the servo enable signal is received, but not means that the command can be input.

2.4.2 Alarm

■ During DB deceleration and free running deceleration

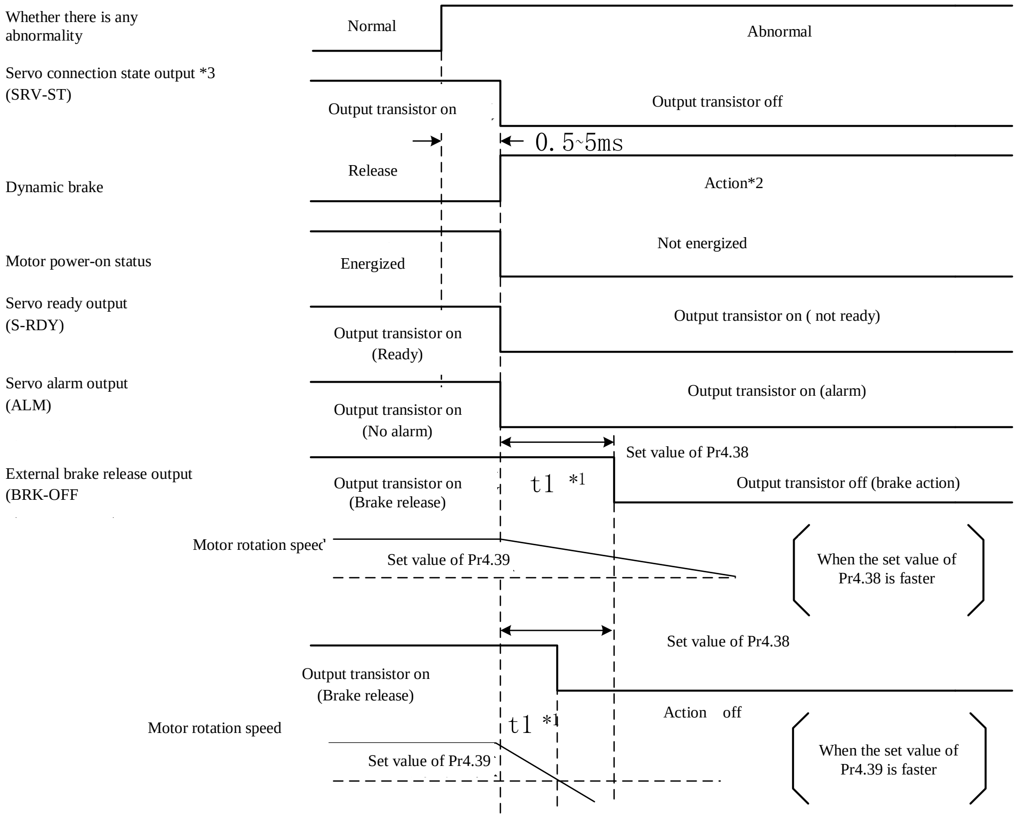


Figure 2.4.2-1 The state during DB deceleration and free running deceleration

■ When the action is stopped immediately

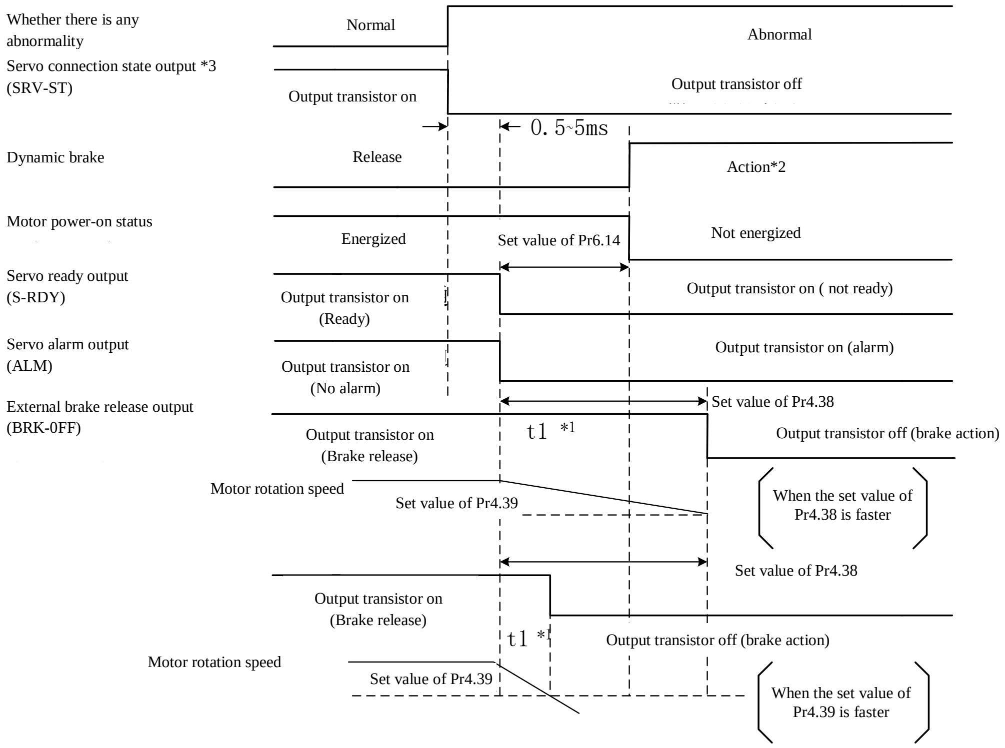


Figure 2.4.2-2 The state when the action is stopped immediately

Note:

1. t1 is the set value of "Mechanical brake action setting during action". In addition, this time is shorter than the time it takes for the motor to reach the set speed of Pr4.39 "Brake release speed setting". Unrelated to Pr4.37 when the motor is stopped, t1 is 0.
2. The action of the dynamic brake when an alarm occurs is determined by the parameter value of Pr5.10 "Alarm timing".
3. Pleas note that the servo enable state output (SRV-ST) means that the servo enable signal is received, but not means that the command can be input.
4. It is recommended that Pr4.38 "Mechanical brake action setting during action" = Pr6.14 "Instant stop time when alarming".

When Pr4.38 ≦ Pr6.14, the brake will act after the time of Pr4.38.

When Pr4.38 > Pr6.14, the brake will not act after the time of Pr4.38, but will act when it is switched to no power-on state.

- When the alarm is cleared (status of servo enable on command)

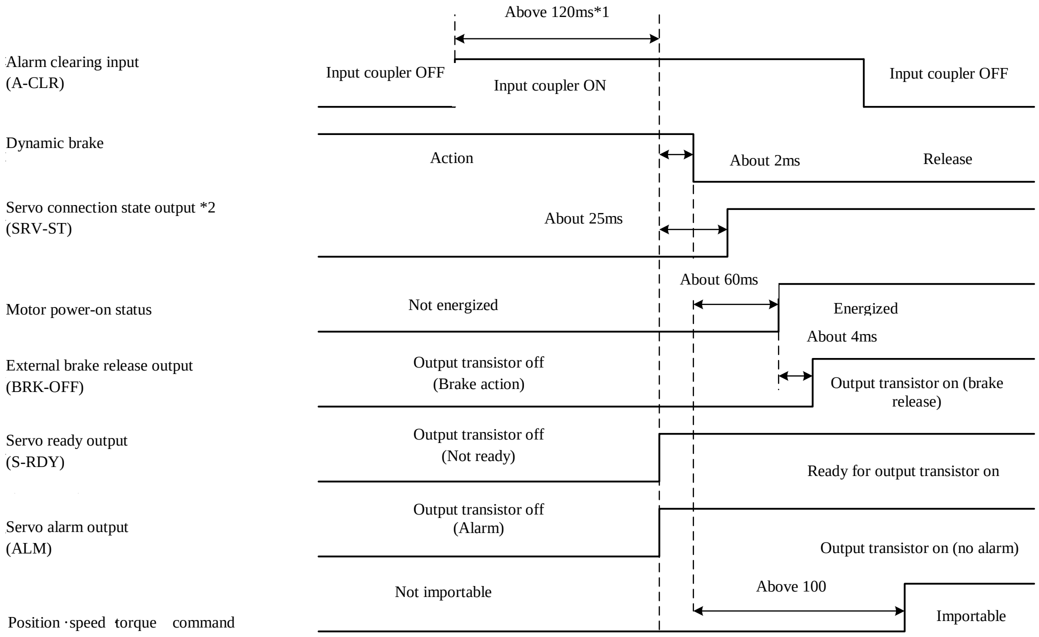


Figure 2.4.2-3 Servo enable command status when the alarm is cleared

Note:

1. The identification time of alarm clearing can be set via Pr5.16 “Alarm clearing input setting”.
2. Pleas note that the servo enable state output (SRV-ST) means that the servo enable signal is received, but not means that the command can be input.

- Switching on and off when the motor is stopped (servo locked)

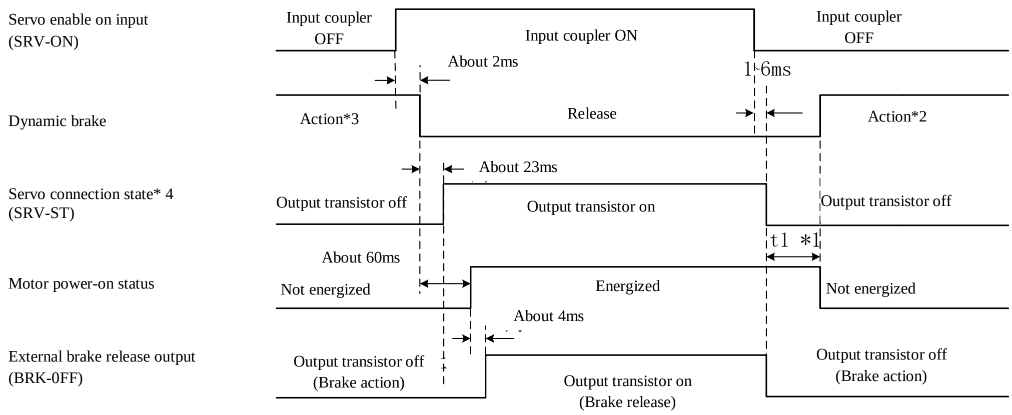


Figure 2.4.2-4 Switching on and off when the motor is stopped (servo locked)

Note:

1. t1 is the set value of “Mechanical brake action setting when stopped”.
2. The dynamic brake action when the servo enable is off is determined by the set value of Pr5.06 “The time sequence when the servo enable is switched off”
3. The servo enable is not on when the motor rotation speed is not below about 30r/min.
4. Pleas note that the servo enable state output (SRV-ST) means that the servo enable signal is received, but not means that the command can be input.

2.4.3 Servo enable on and off

- Servo enable on and off action when the motor is rotating

Requirements: the timing diagram in case of emergency stop or tripping cannot be used repeatedly.

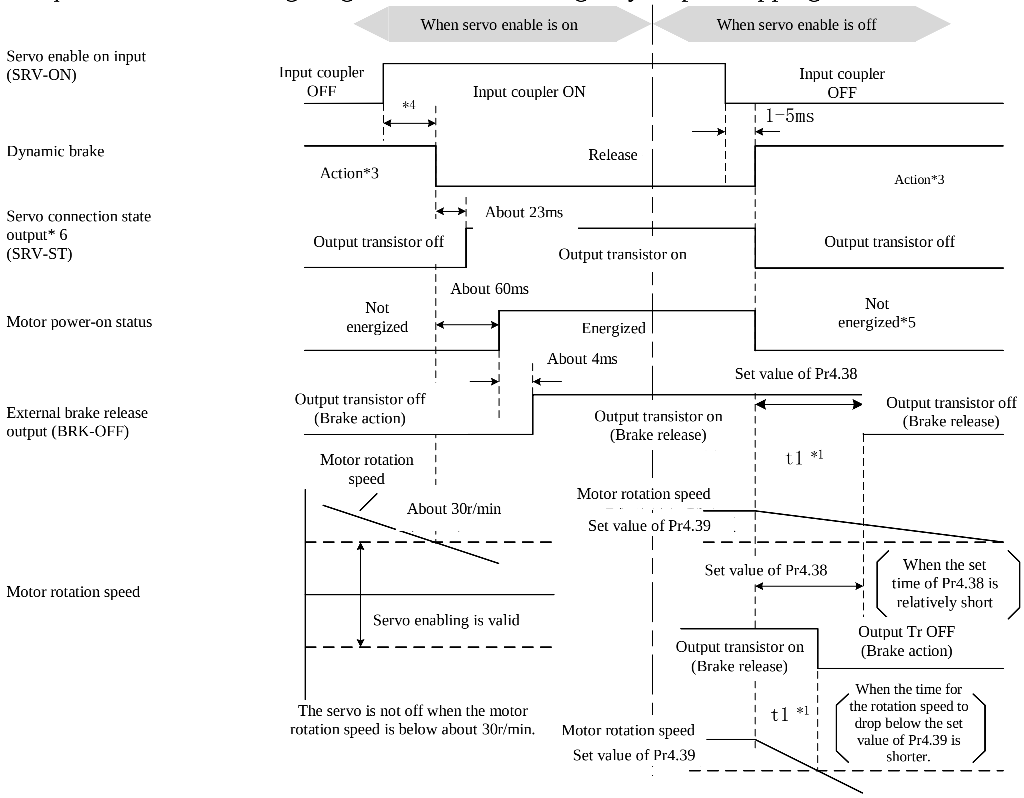


Figure 2.4.3-1 Servo enable on and off action when the motor is rotating

Note:

1. t1 is the shorter of set time of “Mechanical brake action setting during action” and the time for the motor rotation speed drop to the speed set under Pr4.39.
2. Even if the SRV-ON signal of motor is powered on in deceleration, it will not become servo enable state until it stops.
3. The dynamic brake action when the servo enable is off is determined according to the set value of Pr5.06 “The time sequence when the servo enable is switched off”.
4. The servo enable is not on before the motor rotation speed is below about 30r/min.
5. The motor energizing state in deceleration when the servo enable is off is determined by the set value of Pr5.06 “The time sequence when the servo enable is switched off”
6. Pleas note that the servo enable state output (SRV-ST) means that the servo enable signal is received, but not means that the command can be input.

2.5 Built-in holding brake of the motor

2.5.1 Outline

When the motor is used to drive a vertical shaft, etc., to prevent the moving part from falling due to gravity when the power supply of the driver is cut off, a holding brake should be used.

Note:

The built-in holding brake of the motor is only used for the purpose of maintaining the stopped state ("for holding"). Please do not use it for the purpose of stopping the running of motor load ("for stopping")

■ Connection example

The connection example when using the external brake release output signal (BRK-OFF) of the driver to control the holding brake is shown in the following figure.

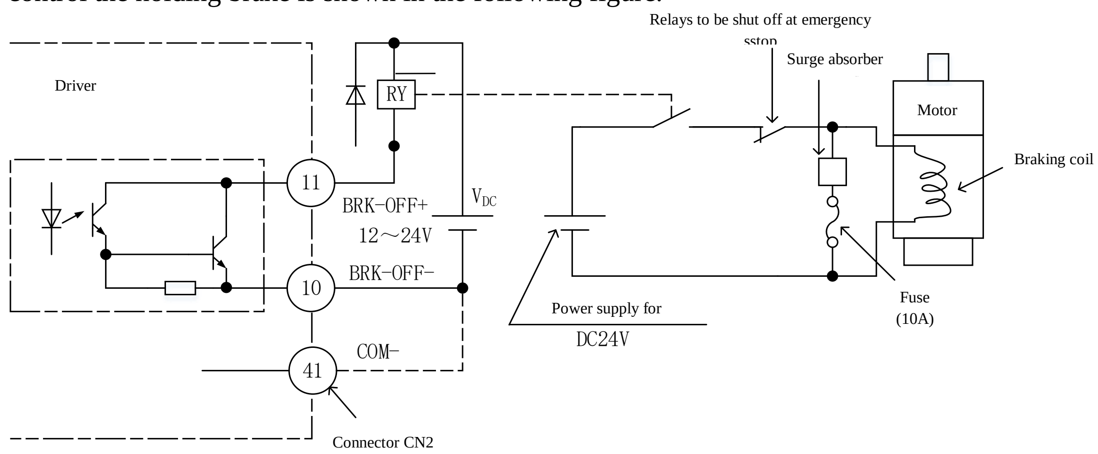


Figure 2.5.1-1 The external brake release output signal in the use of driver

Note:

1. The polarity of brake coil depends on the specific model of motor.
2. The power for brake should be prepared by the client. In addition, the power for brake and the control signal power supply (VDC) should not be shared.
3. To suppress surge voltage caused by connection/disconnection operation of relay (RY), please install a surge absorber as shown in the figure. When using diodes, it is necessary to keep the time of brake from release to action, which is slightly slower than using surge absorbers.
4. The impedance of wire varies with the length of wiring. There may be a surge voltage during connection and disconnection. To control the coil voltage of the relay and the voltage between terminals of the brake, please select an appropriate surge absorber.

■ Output timing of BRK-OFF signal

1. Please refer to Section 2.4 "Timing diagram" for the release timing of the holding brake when the power is switched on and the brake action timing when the servo enable is off/alarmed when the motor rotates.
2. When the servo enable is turned off while the motor is rotating, or in case of an alarm, the time from opening to BRK-OFF signal off (maintain brake action) depending on the motor rotation state can be set by adopting parameters (Pr4.38: Mechanical brake action setting during action). For details, please refer to Section 4.3.5.

Notes:

1. When the motor with a built-in brake is running, the brake may make a snap sound, which will have no effect on the function;
2. Magnetic flux leakage may occur at the shaft end or other parts when the brake coil is energized (keep the

brake open). Please pay attention when using magnetic sensor and other instruments near the motor.

2.5.2 Specifications

1. OM1 motor brake specifications

Motor series	Power of motor	Purpose	Rated voltage (V)	Rated current (A)	Static friction torque (N·m)	Absorption time (ms)	Release time (ms)	Release voltage (V)
OMS1	200W, 400W	Keep using	DC24V ±10%	0.3	1.27 or more	50	15	DC1V or more
	750W	Keep using	DC24V ±10%	0.4	2.39 or more	70	20	DC1V or more
	1.0kW(□80)	Keep using	DC24V ±10%	0.47	3.18 or more	70	20	DC1V or more
	1.0kW(□100) 1.5kW, 2.0kW	Keep using	DC24V ±10%	1	7.8 or more	120	30	DC1V or more
OMM1	50W	Keep using	DC24V ±10%	0.25	0.16 or more	35	20	DC1V or more
	100W				0.32 or more			
	1.0kW, 1.5kW, 2.0kW	Keep using	DC24V ±10%	1	9.55 or more	120	30	DC1V or more
OMD1	50W	Keep using	DC24V ±10%	0.25	0.16 or more	35	20	DC1V or more
	100W				0.32 or more			
	200W, 400W	Keep using	DC24V ±10%	0.3	1.27 or more	50	20	DC1V or more
OMG1	850W	Keep using	DC24V ±10%	0.41	12.7 or more	100	60	DC1V or more
	1.3kW	Keep using	DC24V ±10%	0.41	19.6 or more	100	60	DC1V or more
OMH1	200W, 400W	Keep using	DC24V ±10%	0.3	1.27 or more	50	15	DC1V or more
	750W	Keep using	DC24V ±10%	0.4	2.39 or more	70	20	DC1V or more
	1.0kW, 1.5kW	Keep using	DC24V ±10%	1	9.55 or more	120	30	DC1V or more

2. OM2 motor brake specifications

Motor model	Power of motor	Purpose	Rated voltage (V)	Power of motor (W)	Static friction torque (N·m)	Absorption Time (ms)	Release time (ms)	Release voltage (V)
OMS2	100W	Keep using	24	6	0.64	35	20	DC1V
	200W, 400W	Keep using	24	7	1.3	50	15	DC1V
	750W	Keep using	24	12	3.2	70	20	DC1V
	1.0kW	Keep using	24	20	15	110	50	DC2V or more
OMM2	1.0kW, 3.0kW	Keep using	24	20	15	110	50	DC2V or more
OMG2	0.85KW, 1.8kW	Keep using	24	20	15	110	50	DC2V or more
OMH2	200W, 400W	Keep using	24	7	1.3	50	15	DC1V
	750W	Keep using	24	12	3.2	70	20	DC1V
	1.0kW(□80)	Keep using	24	20	15	110	50	DC2V or more
	1.0kW(□130)~3.0kW	Keep using	24	20	15	110	50	DC2V or more

About the motor brake:

1. Do not use the brake for braking.
2. Be sure to release the brake when the motor is running.
3. Please use a power supply with reinforced insulation from SELV power supply/hazardous voltage.
4. The brake has polarity（OM1 series）, so please connect it as shown below.

Motor output power 750W and below: BRK+ (yellow): DC24V, BRK- (blue): GND
Motor output power 850W or above: BRK+ (PinNo.1): DC24V, BRK- (PinNo.2): GND

5. The accuracy of the encoder will decline if the braking voltage is lower than 12v or it is used in the opposite polarity state.

2.6 Dynamic brake

2.6.1 Summary

1. The dynamic brake has an function of emergency stop.

> Do not start/stop the motor rotation by turning on/off the servo enable (SRV-ON).
> Otherwise, the built-in dynamic brake circuit of the drive may be damaged.

> When the motor is driven from the outside, it is a generator and is not affected by the power supply. Since a short-circuit current flows when the dynamic brake is activated, if it is continuously driven from the outside, the driver may cause smoking or fire

2. The dynamic brake can only be used for a short time and for emergency stop only. After the dynamic brake has been activated under high-speed rotation, it cannot used again in 10 minutes.

●The dynamic brake can operate in the following situations.

①When the main power is off
②At Servo-OFF
③When the protection function is activated
④When the drive input disabled (NOT, POT) of terminal CN2 is activated

That using the dynamic brake to activate or run freely during deceleration or after a stop in cases of ①~④ above can set by parameter selection.

●Please use the following external dynamic brake resistor.

Driver		Specifications of each resistor		Usage quantity
Model	Voltage	Resistance	Power	
Ω6	200V	1.2Ω	400W	3

2.6.2 Condition set diagram

① The driving condition setting for deceleration→stop (Pr5.07) after turning off the main power supply

Time sequence when turning off the main power (Pr5.07) Setting value of Pr5.07	Driving condition: Slowing down	Driving condition: After stopping	Deviation counter content
0	D B	D B	Free running
1	Free running	D B	Clear
2	D B	Free running	Clear
3	Free running	Free running	Clear
4	D B	D B	Keep up
5	Free running	D B	Keep up
6	D B	Free running	Keep up
7	Free running	Free running	Keep up
8	Stop immediately	D B	Clear
9	Stop immediately	Free running	Clear

When the setting values are 8 and 9, the torque limit for immediate stop is the set value of Pr5.11 (torque setting at immediate stop).

②The driving condition setting of deceleration→stop (Pr5.06) after the servo enable is turned off

Time sequence when servo enable is off (Pr5.06)

Setting value of Pr5.06	Driving conditions: Slowing down	Driving conditions: After stopping	Deviation counter content
0	D B	D B	Clear
1	Free running	D B	Clear
2	D B	Free running	Clear
3	Free running	Free running	Clear
4	D B	D B	Keep up
5	Free running	D B	Keep up
6	D B	Free running	Keep up
7	Free running	Free running	Keep up
8	Stop immediately	D B	Clear
9	Stop immediately	Free running	Clear

When the setting values are 8 and 9, the torque immediate stop is limited to the setting value of Pr5.11 (torque setting at immediate stop).

③The driving condition setting of deceleration→stop after the protection function is activated(Pr5.10)

Time sequence at alarm (Pr5.10)

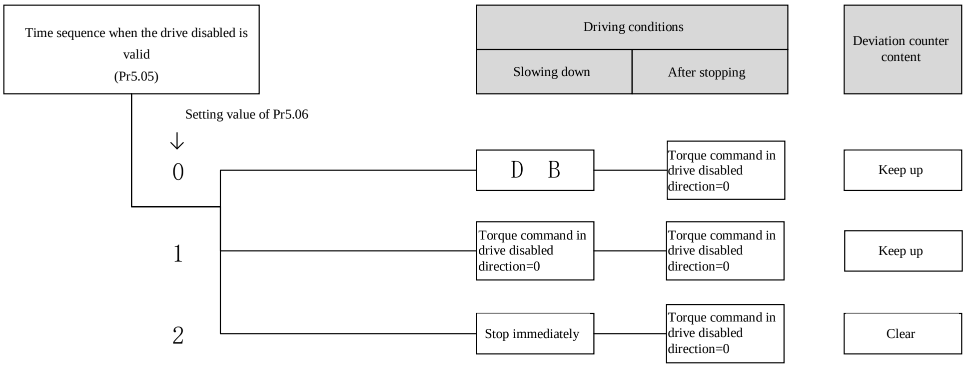
Setting value of Pr5.06	Driving conditions: Slowing down	Driving conditions: After stopping	Deviation counter content
0	D B	D B	Keep up
1	Free running	D B	Keep up
2	D B	Free running	Keep up
3	Free running	Free running	Keep up
4	Action A: Stop immediately Action B: DB	D B	Keep up
5	Action A: Stop immediately Action B: Free running	D B	Keep up
6	Action A: Stop immediately Action B: DB	Free running	Keep up
7	Action A: Stop immediately Action B: Free running	Free running	Keep up

When the setting values are 4~7, follow action A if the protection function corresponding to the immediate stop is activated; otherwise, follow action B.

Please keep the main circuit power on during the deceleration before stop.

The deviation counter during activation of the protection function is cleared when the alarm is released.

④The driving condition setting of deceleration→stop (Pr5.05) when the drive input disabled (NOT, POT) is valid



When the setting value is 2, the torque during deceleration is limited to the setting value of Pr5.11 (torque setting at immediate stop).
The change takes effect when the control power supply is turned on again.

2.7 Setting of command division/multiplication ratio (electronic gear ratio)

The relationship between position resolution& movement speed and command division/multiplication ratio

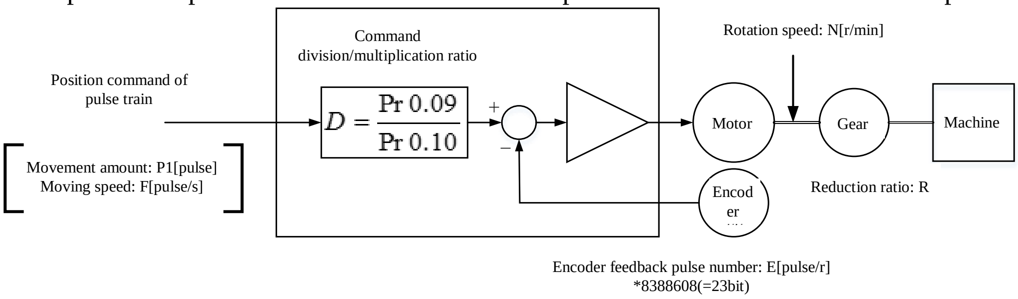


Figure 2.7.1-1 The relationship between position resolution& movement speed and command division/multiplication ratio

Take the screw drive as an example of the machine.

Suppose the screw pitch is L [mm], then the actual movement amount M [mm] of the screw of the relative movement amount command P1 [pulse] is shown in the following formula (1).

$$M = P1 * (D/E) * (1/R) * L ----------(1)$$

Therefore, the position resolution (equivalent to the movement amount ΔM of command 1 pulse) is shown in the following formula (2).

$$\Delta M = (D/E) * (1/R) * L -------------- (2)$$

Change it to formula (2), and the command division/multiplication ratio D is calculated by formula (3).

$$D = (\Delta M * E * R)/L ---------------- (3)$$

In addition, the actual screw moving speed V [mm/s] for the moving speed command F is expressed by the formula (4), and the motor rotation speed N at this time is shown in the formula (5).

$$V = F * (D/E) * (1/R) * L -------------(4)$$

$$N = F * (D/E) * 60 --------------- (5)$$

Transform the formula (5), and calculate the command division/multiplication ratio by formula (6).

$$D = (N * E)/F * 60 --------------- (6)$$

Notice:

①Position resolution ΔM, considering the mechanical error, the machine positioning accuracy Δε is about 1/5~1/10.

② Please set freeely within the range of $1 \sim 2^{30}$ of Pr0.09 and Pr0.10.

③Although the value can be set as any value of the denominator and numerator, normal operation cannot be guaranteed when setting the extreme frequency division ratio or multiplication ratio. Regarding the obtainable range of frequency division and multiplication ratio, please use them within the range of 1/1000~1000 times.

In addition, within the above range, if the multiplication ratio is high, Err27.2 (command pulse multiplication exception protection) may occur due to the variation or interference of the command pulse input.

2^n	A decimal system	2^n	A decimal system
2^0	1	2^{12}	4096
2^1	2	2^{13}	8192
2^2	4	2^{14}	16384
2^3	8	2^{15}	32768
2^4	16	2^{16}	65536
2^5	32	2^{17}	131072
2^6	64	2^{18}	262144
2^7	128	2^{19}	524288
2^8	256	2^{20}	1048576
2^9	512	2^{21}	2097152

2^{10}	1024	2^{22}	4194304
2^{11}	2048	2^{23}	8388608

	Command multiplier ratio $D=\frac{\Delta M \times E \times R}{L}$	$D=\frac{Pr0.09}{Pr0.10}$
Screw pitch L=10 mm Reduction ratio R=1 Position resolution ΔM＝0.0005mm When the encoder is 23bit ($E=2^{23}$P/r)	$\frac{0.0005 \times 2^{23} \times 1}{10}=\frac{5 \times 2^{23}}{10\times 10^4}=\frac{41943040}{100000}$	Pr0.09=41943040 Pr0.10=100000

	Motor rotation speed(r/min) $N=F\times\frac{D}{E}\times 60$		
Screw pitch L=20mm Reduction ratio R=1 Position resolution ΔM＝0.0005 mm Line driver pulse input 500kpulse/s When the encoder is 23bit	$500000\times\frac{0.0005 \times 2^{23}}{20}\times\frac{1}{2^{23}}\times 60=750$		
Same as above To reach 2000r/min	Command division/multiplication ratio	$D=\frac{N \times E}{F \times 60}$	$D=\frac{Pr0.09}{Pr0.10}$
	$D=\frac{2000 \times 2^{23}}{500000 \times 60}=\frac{2000 \times 2^{23}}{2000 \times 500 \times 30}=\frac{8388608}{15000}$		Pr0.09=8388608 Pr0.10=15000
	Movement amount of command pulse (mm) Position resolution $\Delta M=\frac{D}{E}\times\frac{1}{R}\times L$		
	$\frac{2000 \times 2^{23}}{500000 \times 60}\times\frac{1}{2^{23}}\times\frac{1}{1}\times 20=0.00133\ mm$		

2.8 Use method of front panel:

2.8.1 Setting

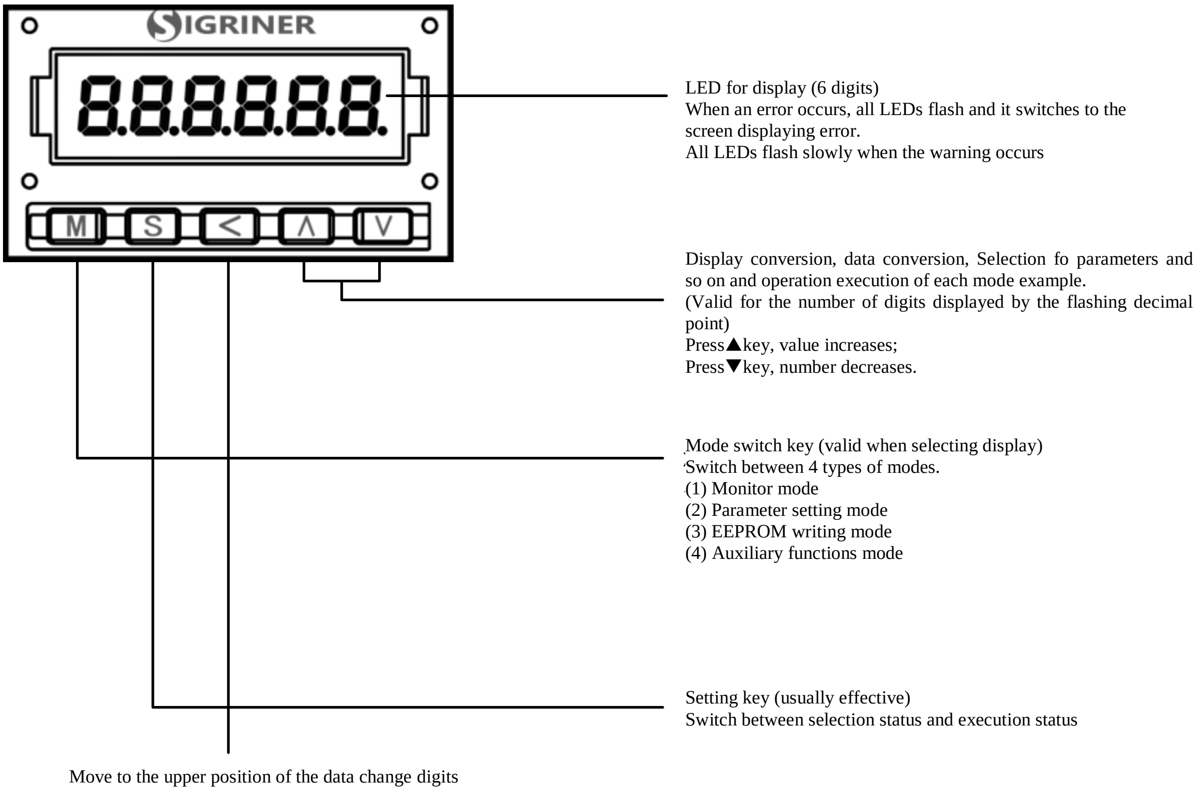


Figure 2.8~1-1 Setting

■ The initial state of the front panel display (7-segment LED)

(1) Status

When the drive is powered on, the display status of the front panel is as shown in the figure below.

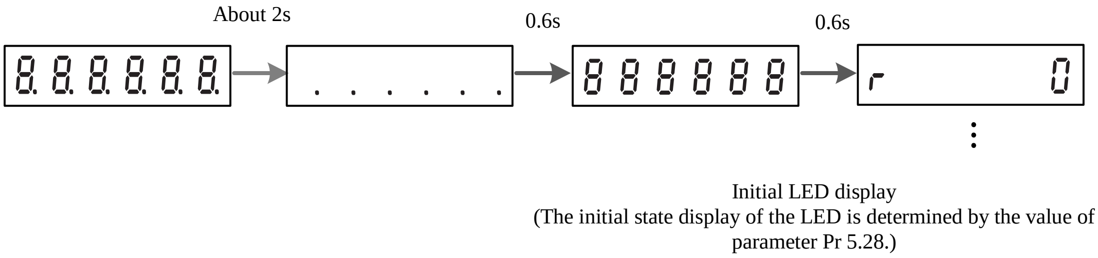


Figure 2.8.1-2 Status

(2) When a warning occurs
When a drive warning occurs, the display on the front panel is as shown below.
In addition, when a warning occurs, the following (0.8-second display/0.3-second display) will be repeatedly displayed.

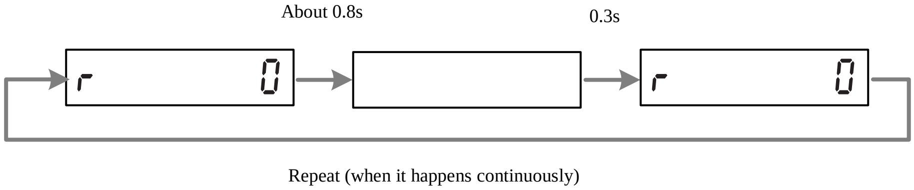


Figure 2.8.1-3 display repeatedly

The cause of the alarm is shown in the table below:

Warning number	Warning name	Content
A0	Overload warning	The load rate is more than 85% of the protection level
A1	Over-regeneration warning	Regenerative load rate is more than 85% of the protection level
A2	Battery warning	Battery voltage is lower than normal

2.8.2 Various mode content

Selection of status: display the corresponding items execution status in each mode: display the content when performing each function specifically. The content of each mode is shown in the figure below, and the steps of mode switching can be carried out using various buttons.

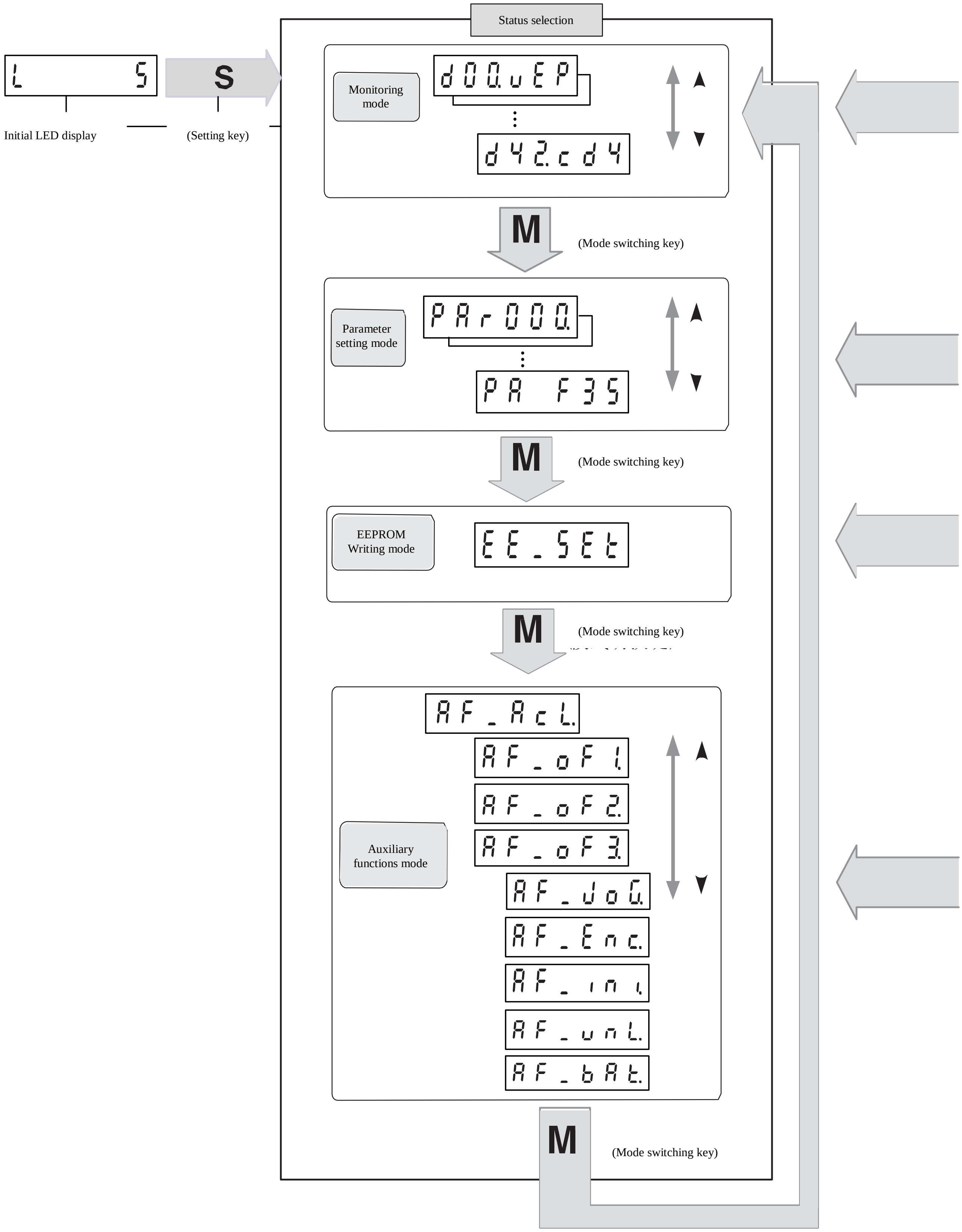


Figure 2.8.2-1 Mode content

Note: the number of digits moved when using the to change blinking decimal point "·"

After the power is turned on, the monitor mode execution display can be selected arbitrarily according to the setting of parameter Pr5.28 "LED initial state".

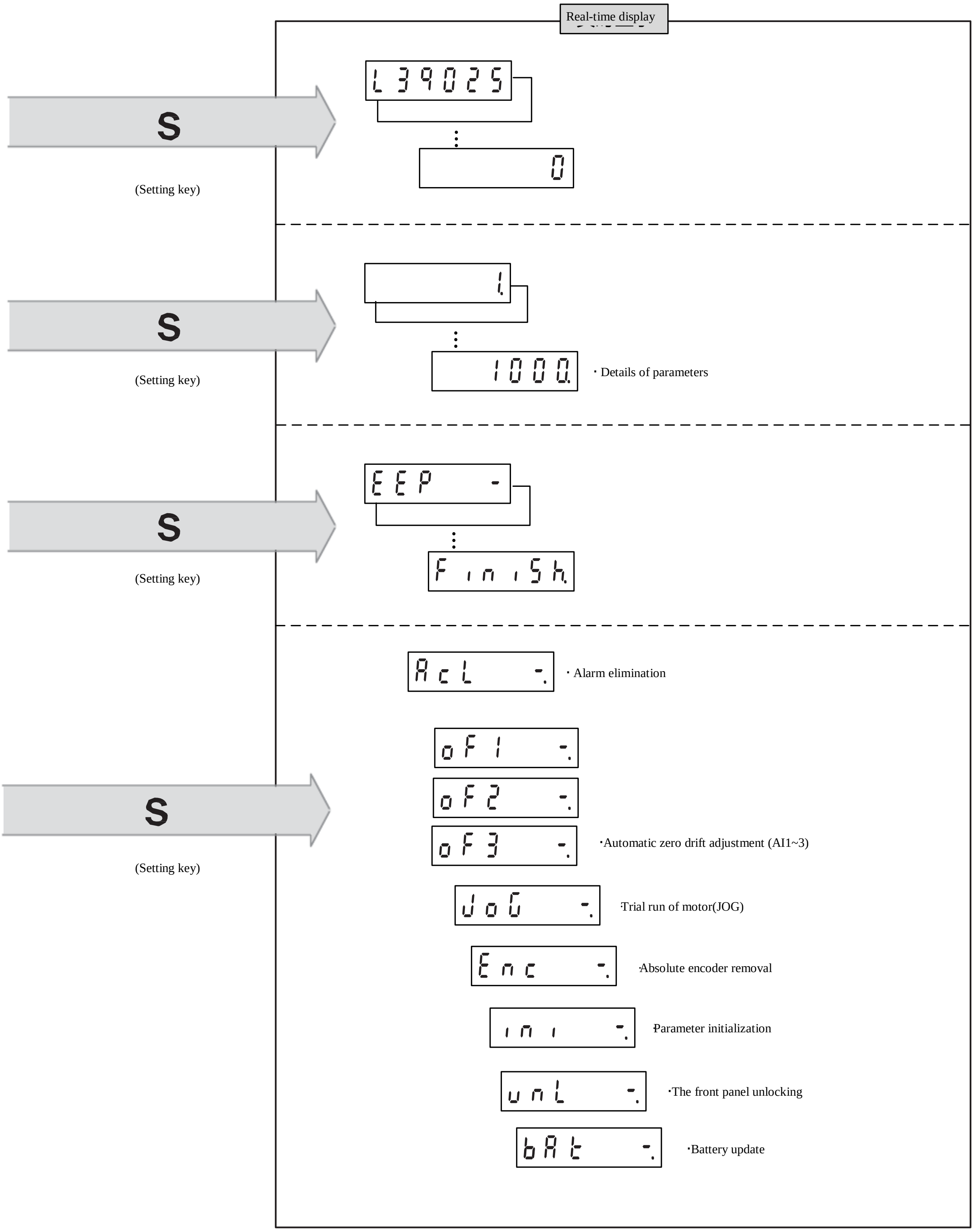


Figure 2.8.2-2 Monitor Mode

2.8.3 Front panel locking

1. Summary

The front can be locked in order to prevent wrong actions such as unexpected parameter changes.
The restricted items when the front panel is locked are as follows:

Mode	Front panel locking status
Monitoring mode	Unlimited, all monitoring data can be viewed
Parameter setting mode	The parameters cannot be changed, but can be viewed
EEPROM writing mode	Inexecutable (cannot be displayed)
Auxiliary functions mode	Auxiliary functions other than "front panel unlocking" are not executable (Display unavailable)

2. Operation methods

Related parameters

Parameter No.		Parameter name	Function
classification	NO.		
5	35	Front panel locking	Perform locking based on front panel

Locking/unlocking method:

<table>
<tr><th>Process</th><th>Front panel</th><th>Install and debug software "ServoMonitor"</th></tr>
<tr><td>Locking</td><td colspan="2">①Set Pr5.35 "Front panel lock" = 1, write to EEPROM.
②Turn on the power of the drive again.
③ Front panel in locking status</td></tr>
<tr><td>Dismiss</td><td>① Perform the front panel unlocking function in auxiliary function mode.
②Turn on the power of the drive again.
③Unlock the front panel.</td><td>①Set Pr5.35 "Front panel lock"=0, write to EEPROM.
②Turn on the power of the drive again.
③Unlock the front panel.</td></tr>
</table>

2.8.4 Exclusive function by communication

In order to prevent competition between communication (USB/RS485/Modbus) and the front panel when operating simultaneously, the following exclusive functions are set according to each state.

<table>
<tr><th>Status</th><th>Content of exclusive function</th></tr>
<tr><td>Use the front panel to enter execution states other than monitor mode</td><td>When writing parameters through communication or perform EEPROM writing, the corresponding operation cannot be performed since an error occurs to command.
In addition, it cannot be connected to the installation and debugging software.</td></tr>
<tr><td>After RS485/Modbus communication obtains the right to execute</td><td rowspan="2">At this time ,functions other than the monitor mode can not be used in the front panel.</td></tr>
<tr><td>Installing and debugging software (USB communication) connecting</td></tr>
</table>

2.8.5 Monitoring mode (selection of state)

When you need to change the monitor display settings, select Status selection to the display you want to change into, and then press S to change to Execution state. After changing, press **S**again to return to the selection display.

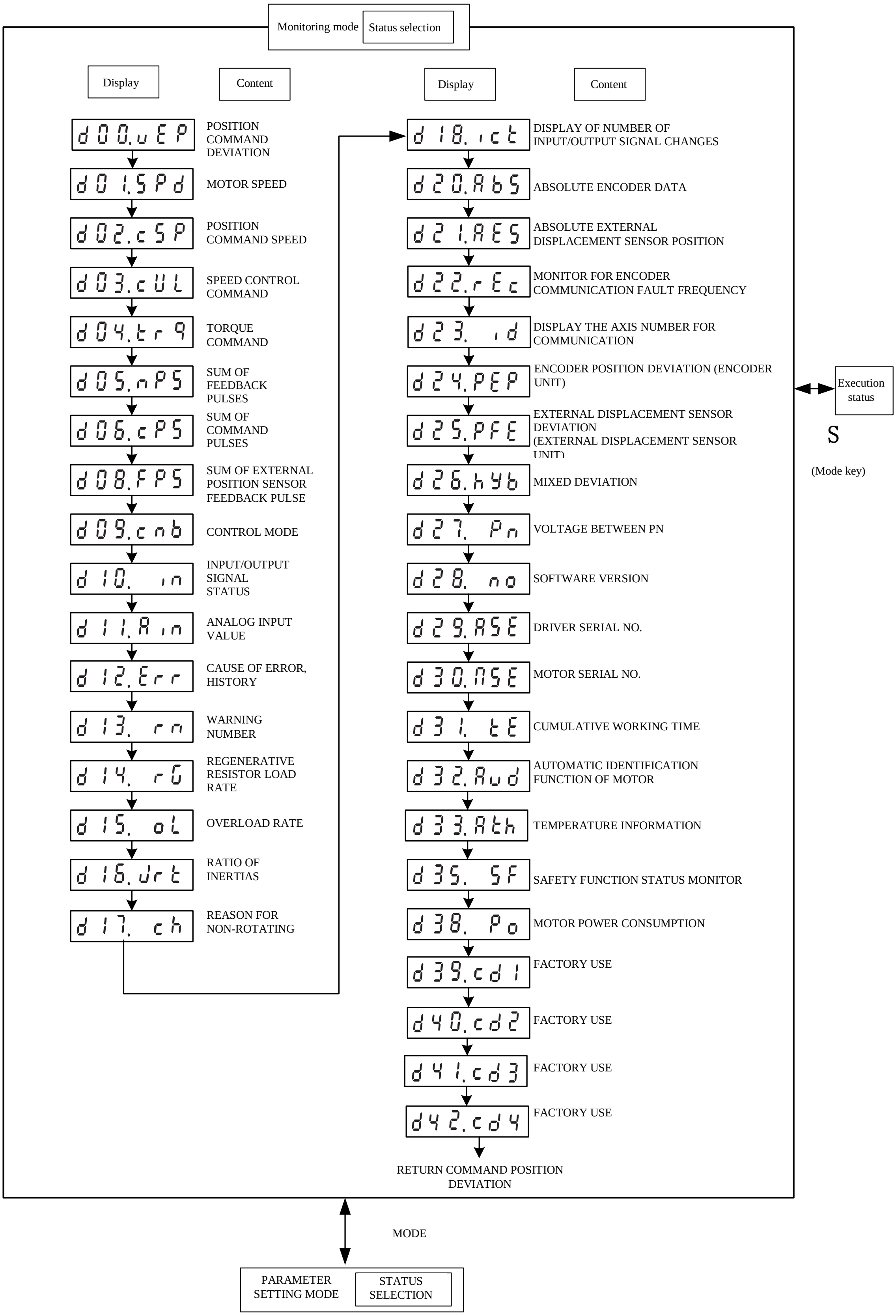
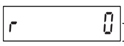


Figure 2.8.5-1 Change monitor display

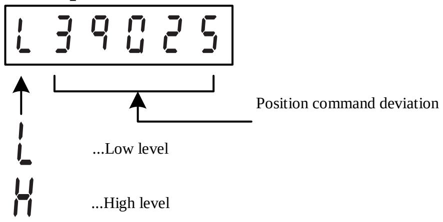


Note: After the drive is bought back, it will be displayed after power-on (when the motor stops).

If you need to change the power-on display, please change the setting of Pr5.28 (LED initial state).

2.8.6 Monitoring mode (execution status)

1. Display of position command deviation [command unit]
Displays the high/low level of the position deviation of the command unit.



■Press the◀ key to switch between the low position (L) ·and the high position (H).
In the following example, the position command deviation=10339025

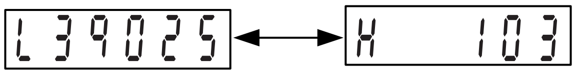


Figure 2.8.6-1 Position command deviation display

2. Display of motor speed, position command speed, speed control command, and torque command
●Motor speed [r/min]

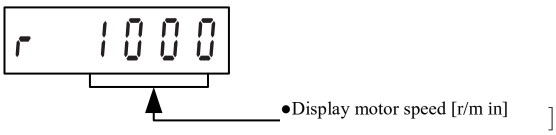


Figure 2.8.6-2 Motor speed

●Position command speed [r/min]

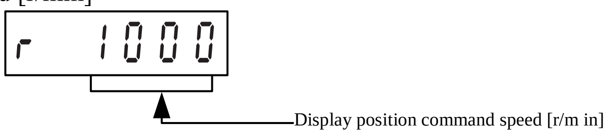


Figure 2.8.6-3 Position control instruction

●Speed control command [r/min]

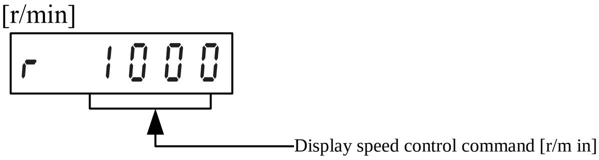


Fig. 2.8.6-4 Command of speed control command

●Torque command

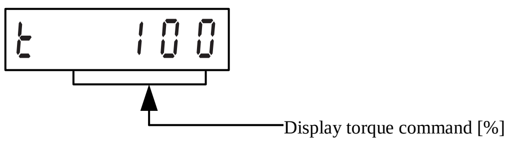


Figure 2.8.6-5 Torque command

3. The display of the total feedback pulse and the total command pulse; the display of the total feedback pulse of the external displacement sensor
●Sum of feedback pulse [encoder feedback pulse]

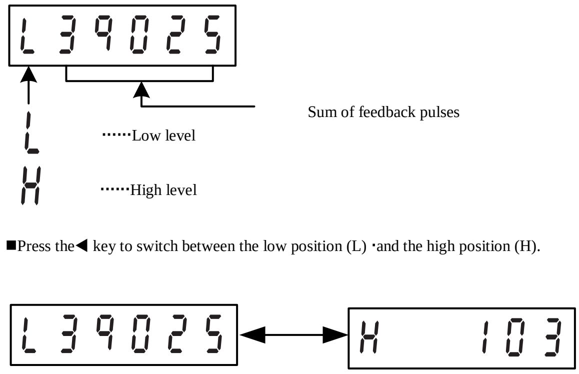


Figure 2.8.6-6 Sum of Feedback pulse

●Command pulse sum [command pulse]

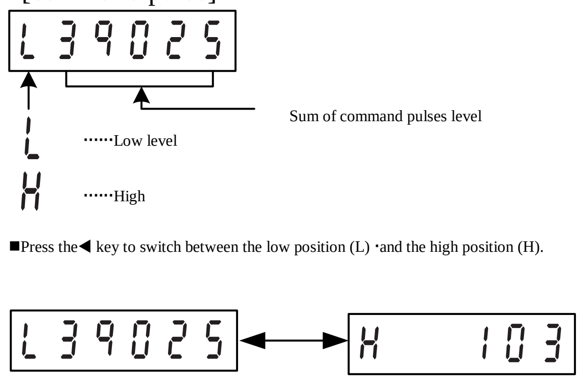


Figure 2.8.6-7 Sum of command feedback pulse

● Sum of external displacement sensor feedback pulse

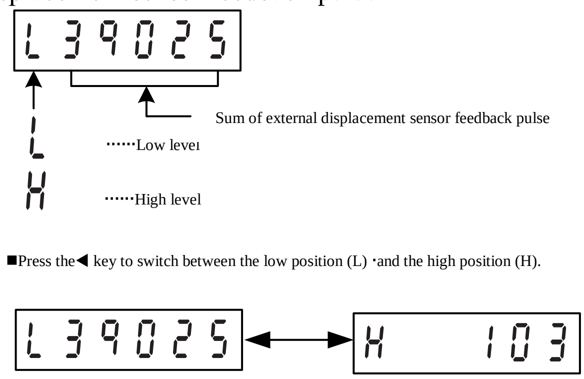


Figure 2.8.6-8 Sum of command feedback pulse

4.Control mode display

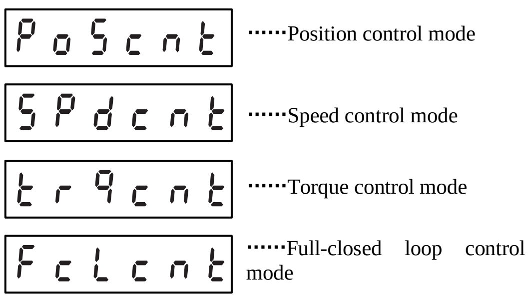
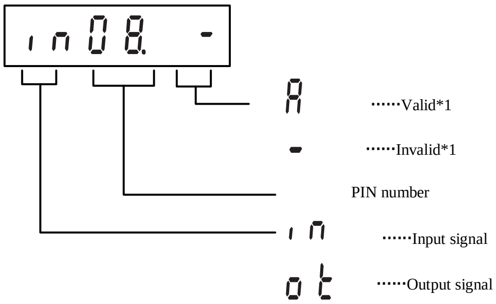


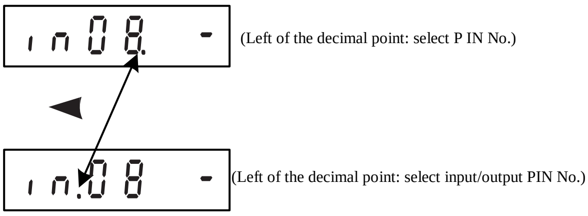
Figure 2.8.6-9 Control mode display

5. Display of input and output signal status

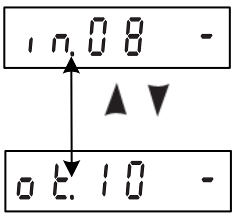
Display the I/O signal status of connector CN2, please use it to check whether the wiring is correct.



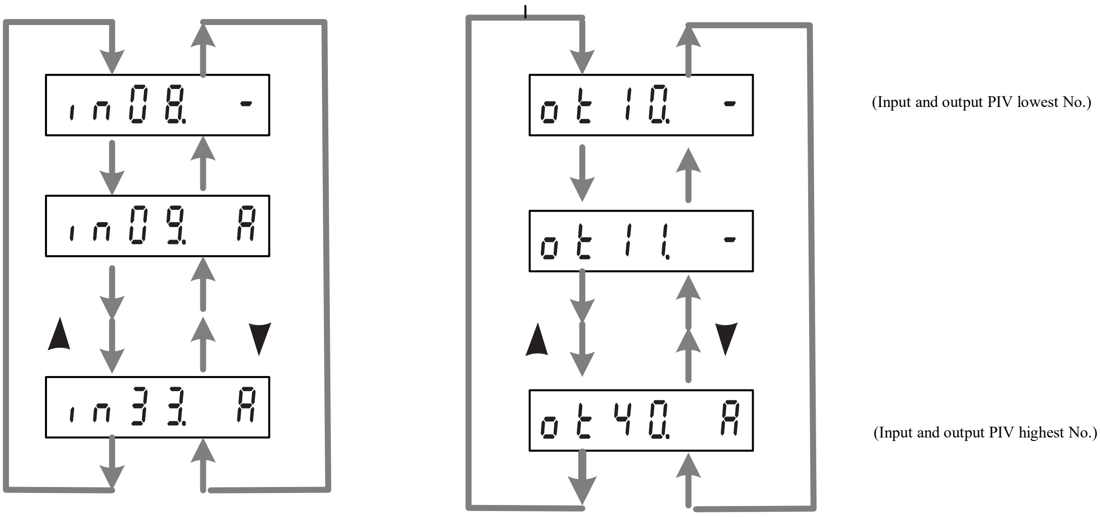
·Move the flashing decimal point through ◀key.



Press·▲▼key to switch input/output



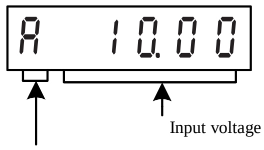
■Press▲▼key to select the P IN No. you want to monitor.



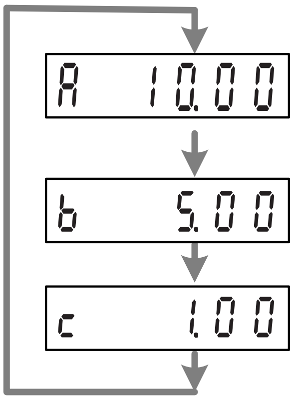
*1 Valid for input signal: input signal photocoupler 0N
Invalid: Input signal photoelectric coupler OFF
The output signal is valid: output transistor 0N
Invalid: output transistor 0FF

Figure 2.8.6-10 Display of input and output signal status

6. Display of analog input value



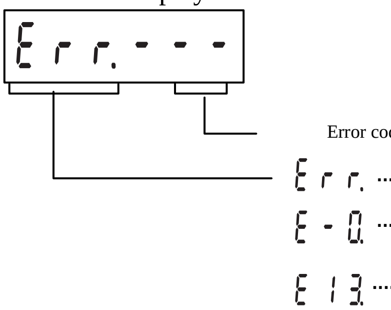
■Press▲▼key to select the P IN No. you want to monitor.



2.15.6-11 Display of analog input value

Note: the voltage will not be displayed correctly if the voltage exceeds ±10V.

7. Display of the cause of the error and reference to the history



·You can refer to previous errors including the 14 ones that are occurring.
Press▲▼, to select the wanted history

Figure 2.8.6-12 Display and history of the cause of the error

List of alarm codes

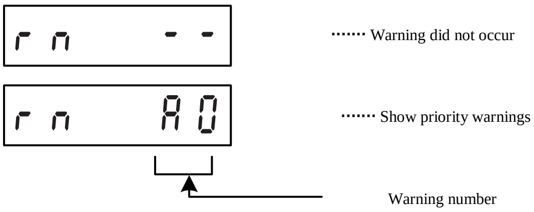
Alarm code		Content	Properties		
Master code	Auxiliary code		History record	Clearable	Stop immediately
12	0	Overvoltage protection	○	○	
13	0	Under-voltage protection for main power supply (insufficient voltage between PN)		○	
	1	Under-voltage protection for main power supply (AC cut off detected)		○	○
14	0	Overcurrent protection	○		
	1	IPM fault protection	○		
15	0	Overheating protection	○		○
	1	Encoder overheating fault protection	○		○
16	0	Overload protection	○	○*1	Switchable*1
	1	Torque saturation fault protection	○	○	
18	0	Regenerative overload protection	○		○

	1	Regenerative transistor fault protection	○		
21	0	Encoder communication disconnection fault protection	○		
	1	Encoder communication fault protection	○		
23	0	Encoder communication data fault protection	○		
24	0	Excessive positional deviation protection	○	○	○
	1	Excessive Speed deviation protection	○	○	○
26	0	Overspeed protection	○	○	○
	1	Second over-speed protection	○	○	
27	0	Command pulse input frequency fault protection	○	○	○
	2	Command pulse frequency multiplication fault protection	○	○	○
28	0	Pulse regeneration limit protection	○	○	○
31	0	Safety function fault protection	○		
33	0	I/F input repeated allocation fault 1 protection	○		
	1	I/F input repeated allocation abnormality 2 protection	○		
	2	I/F input function number fault 1	○		
	3	I/F input function number fault 2	○		
	4	I/F input function number fault	○		
	5	I/F input function number abnormality 2	○		
	6	Counter clear allocation fault	○		
	7	Command pulse disabled input allocation fault	○		
34	0	Motor movable range setting fault protection	○	○	
37	6	PowerID error			
38	0	drive disabled input protection		○	
39	0	Excessive analog input AI1 protection	○	○	○
	1	Excessive analog input AI2 protection	○	○	○
	2	Excessive analog input AI3 protection	○	○	○
40	0	Absolute system battery voltage abnormal protection	○	○*2	
41	0	Absolute counter overflow fault protection			
42	0	Absolute over-speed fault protection	○	○*2	
44	0	Single-loop counting fault protection	○		
45	0	Multi-loop counting fault protection	○		
47	0	Absolute state fault protection	○		
72	0	Temperature sensor fault	○		
87	0	Forced alarm input protection		○	○
92	0	Encoder data recovery fault protection	○		
	6	Encoder position angle recognition failed	○	○	
	7	Load inertia ratio identification failed	○	○	
96	2	Control unit fault protection	○		
98	0	Homing fault	○	○	
99	0	Micro commutation failed	○		

Note: History record.. This error will be recorded.
Clearable...The alarm can be cleared through the alarm clear input. connect the power supply again after addressing the cause of the error.
Stop immediately ... When an error occurs, the operation will be stopped immediately under the control state. (It is necessary to set Pr5.10 “Alarm Sequence"”through other means.)

Note: When an alarm that already has a history occurs, the same error number will display for the error that is occurring and in the history.

8. Warning display



▪Press the ▲▼ key to display the occurrence status of the warning

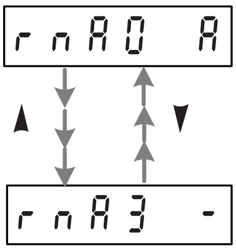


Figure 2.8.6-13 shows the occurrence of a warning

Warning number (16 digits)	Error name	Content	Trigger time *1
A0	Overload warning	The load rate is more than 85% of the protection level	1∽10sor∞
A2	Battery warning	The battery voltage is below 3.2V	∞Fixed

Note: *1 The alarm can be cleared by the alarm clearing function. When the alarm clearing input (A-CLR) is ON, the warning will be recognized as having been cleared for a long time. Under normal circumstances, please be sure to set the alarm clearing input to OFF. In addition, customer parameters can be used to select the trigger time as 1~10s or infinity. However, the battery warning is triggered on the encoder side, so it is set at infinity.

Note: For the warning function, please refer to “Pr4.40, Pr4.41” in Chapter 4 “Parameter Setting”.

9. Display of non-rotating factors

Factors of non-rotating of numbered motor

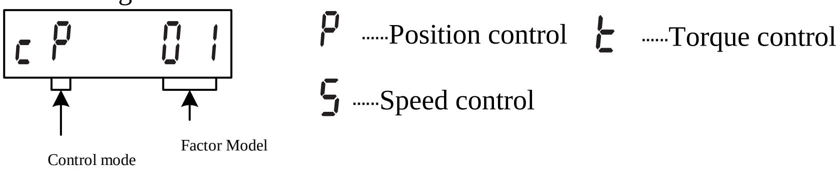


Figure 2.8.6-14 Display of non-rotating factors

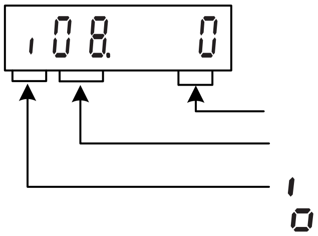
Description of factor No.

No.	Error name	Correlation model			Content
		P	S	T	
Flashing	Errors and warnings occur	○	○	○	An error occurs; a warning occurs
00	No reason	○	○	○	The reason for non-rotation cannot be detected. Rotating normally
01	Non-servo ready state	○	○	○	The main power or control power is not connected. Or the error state is not resolved
02	SRV-ON is not input.	○	○	○	The servo enable input (SRV-ON) is not connected to COM.
03	drive disabled input is valid	○	○	○	When Pr5.04=0 (drive disabled input setting)

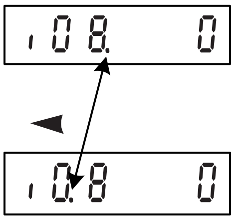
					・If the positive direction drive disabled input (POT) is turned on, the speed command will be in the positive direction. ・If the negative direction drive disabled input (POT) is turned on, the speed command will be in the negative direction.
04	The analog torque limit is invalid and its limit setting is too small	○	○	○	Set the effective torque limit setting value of Pr0.13 (1st) or Pr5.22 (2nd) to less than 5% of the rated value
05	The analog torque limit is valid and its limit setting is too small	○	○		In Pr5.21=0 (torque limit selection) ・If the positive direction analog limit input (P・ATL) is in the negative voltage state, the speed command is in the positive direction. ・If the negative direction analog limit input (N・ATL) is in the positive voltage state, the speed command is in the negative direction.
06	INH input is valid	○			Use Pr5.18=0 (setting of command pulse disabled invalid) to turn on INH
07	The frequency of command pulse input is too low	○			・The command pulse is not input correctly. ・The input selected by Pr0.05 is not connected correctly. ・Failure to match the input command form selected by Pr0.06 and Pr0.07, etc., which leads to the position command of the control cycle below 1 pulse.
08	CL input is valid	○			Pr5.17=0 (counter clearing input mode) connect the deviation counter clear input (CL) and COM.
09	ZEROSPD input is valid		○	○	Pr3.15=1 (ZEROSPD function selection) is valid, turn on the zero-speed clamp input (ZEROSPD).
10	The inter speed command is too small	○			When the analog speed command is selected, the analog speed command is less than 0.06[V].
11	The internal speed command is 0		○		When the internal speed command is selected, the selected internal speed command is set below 30 [r/min].
12	The torque command is too small			○	The analog torque command input ((SPR. or P-ATL) is less than the rated 5[%].
13	The speed limit is too small			○	・When using Pr3.17=0 (speed limit of internal 4th speed) ・Set Pr3.07 4th speed below 30[r/min]. ・When Pr3.17=1 (SPR input for speed limit), the analog speed limit input (SPR) is less than 0.06[V].
14	Other causes	○	○	○	Reasons 1 to 13 have been eliminated, but the motor still runs below 20 [r/min]. (Small command, heavy load, lockd, conflict, driver, motor failure, etc.)

Note: If the motor does not rotate, it may also display a number other than 0. Please refer to Chapter 6 “Troubleshooting”

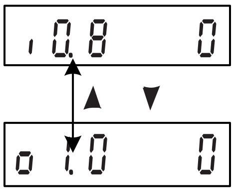
10. The Display of number of input/output signal changes



·Move the flashing decimal point through ◀key



Press▼key to switch input/output



■Press▼key to select the P IN No. you want to display.

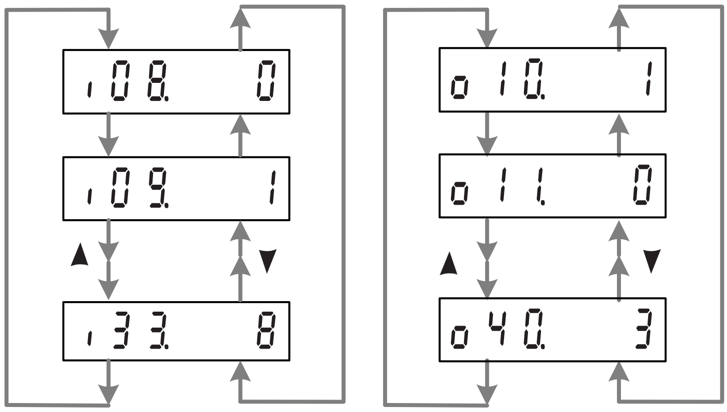
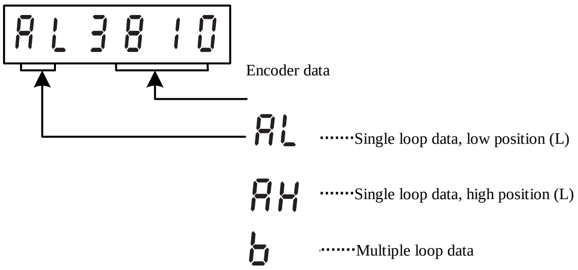


Figure 2.8.6-15 The Display of number of input/output signal changes

11. Display of absolute encoder data



■Press▲▼key to select the No. you want to display.

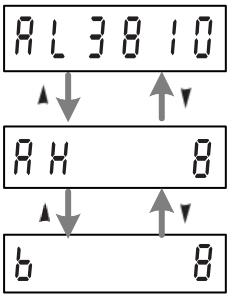
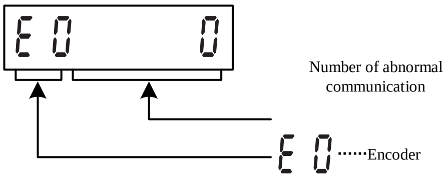


Figure 2.8. Display of absolute encoder data

12. Display of monitor for encoder communication fault frequency



Press▲▼key to switch the encoder and external displacement sensor.

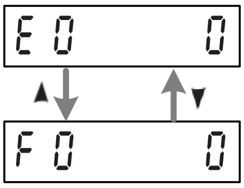


Figure 2.8.6-17 Display of monitor for encoder communication fault frequency

13. Display of the axis number for communication

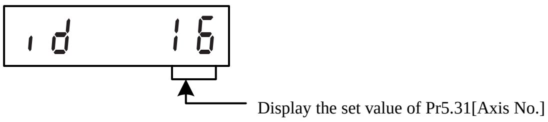


Figure 2.8.6-18 Display of the axis number for communication

14. Encoder position deviation (encoder unit)

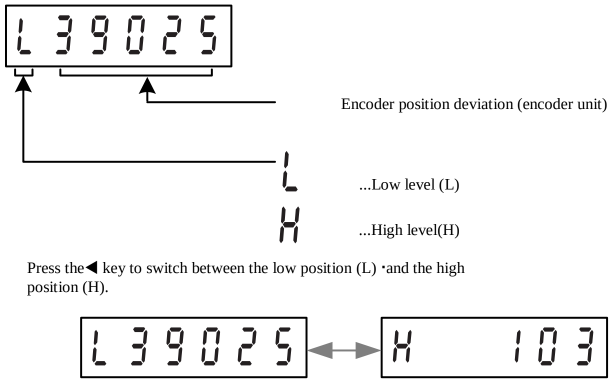


Figure 2.8. Encoder position deviation (encoder unit)

15. Display of voltage between PN Vs

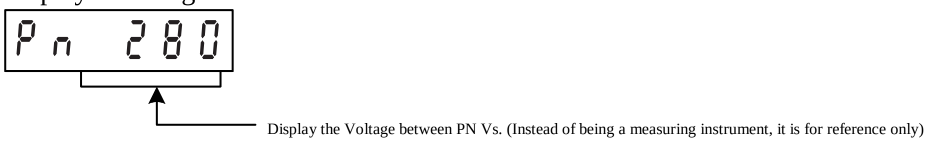


Figure 2.8. 6-20 Display of voltage between PN Vs

16. Software version

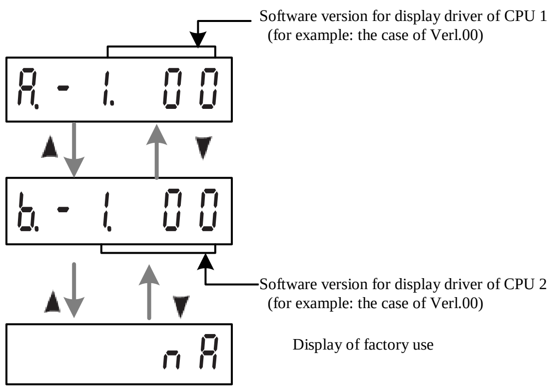


Figure 2.8. 6-21 Software version

17. Display of driver serial number

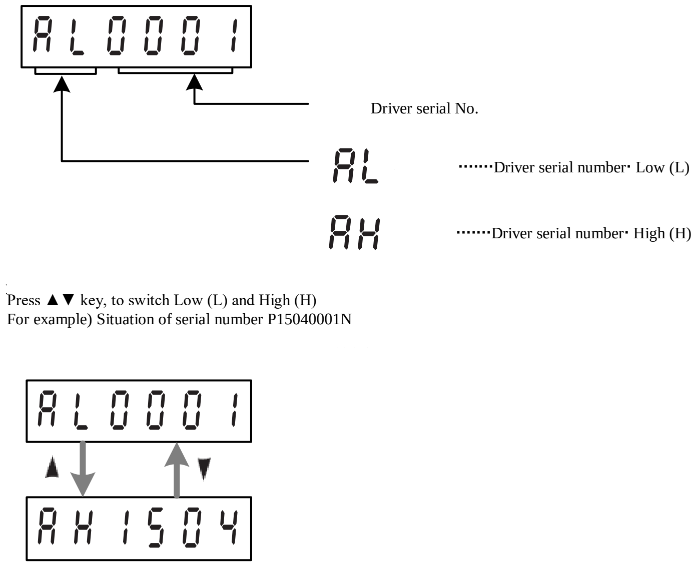
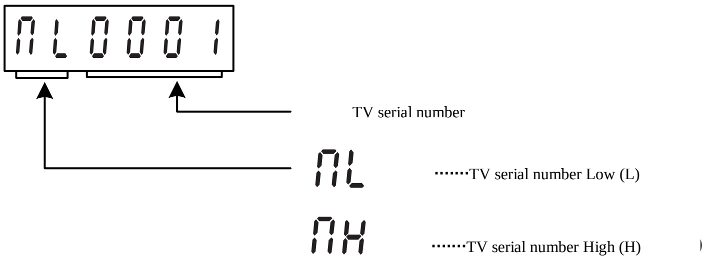


Figure 2.8.6-22 Display of driver serial number

18. Display of motor serial number



Press ▲▼ key, to switch Low (L) and High (H)
For example) Situation of serial number 15040001N

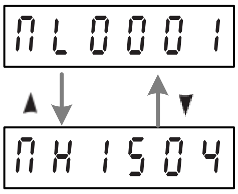


Figure 2.8.6-23 Display of automatic motor identification function

19. Display of Automatic motor identification function

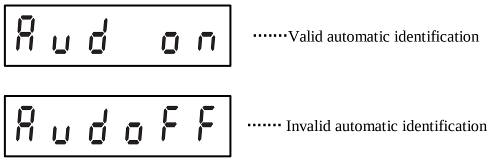
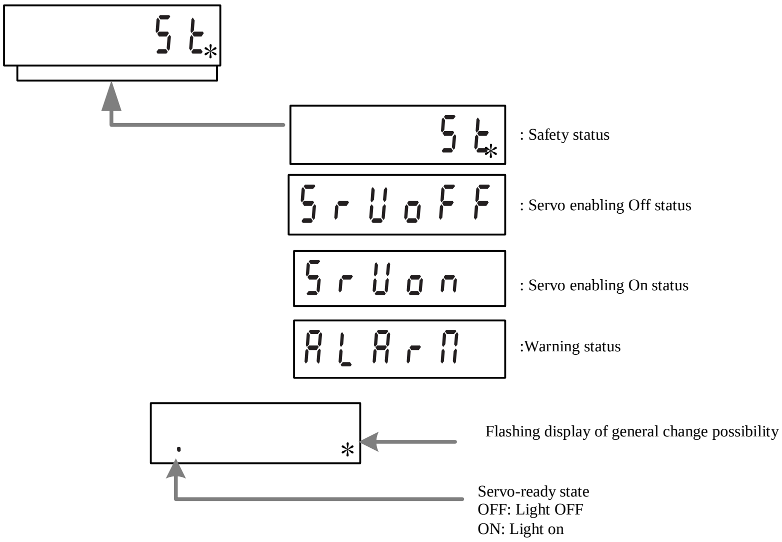


Figure 2.8.6-24 Display of automatic motor identification function

20. Display of safety status monitor



■Press▲▼key to switch the required monitor

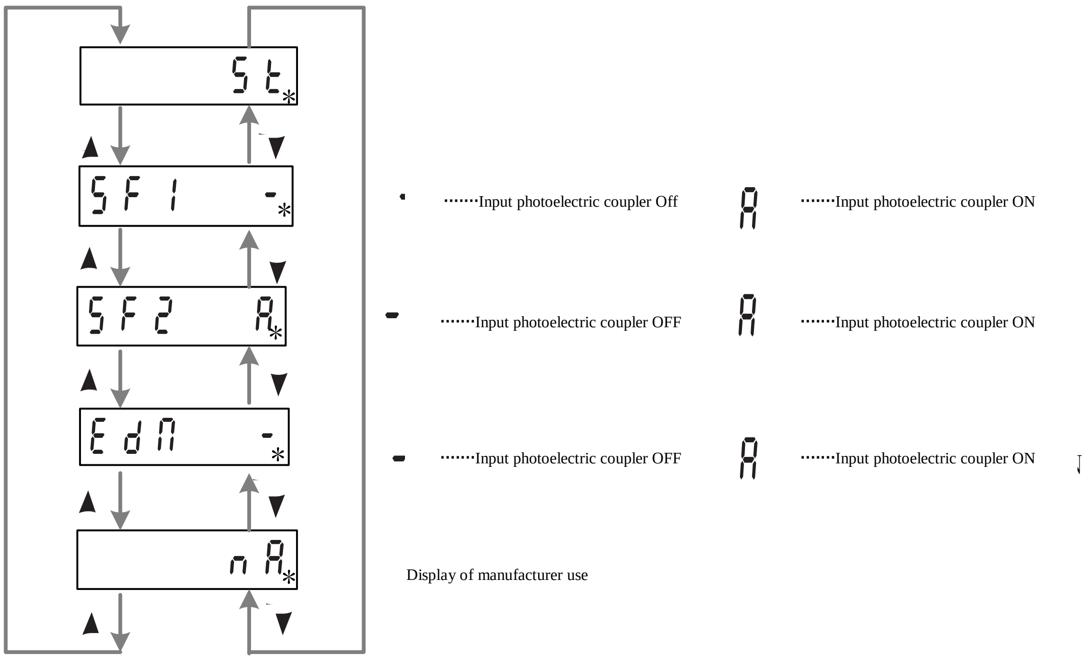


Figure 2.8.6-25 Display of safety status monitor

2.8.7 Parameter setting mode

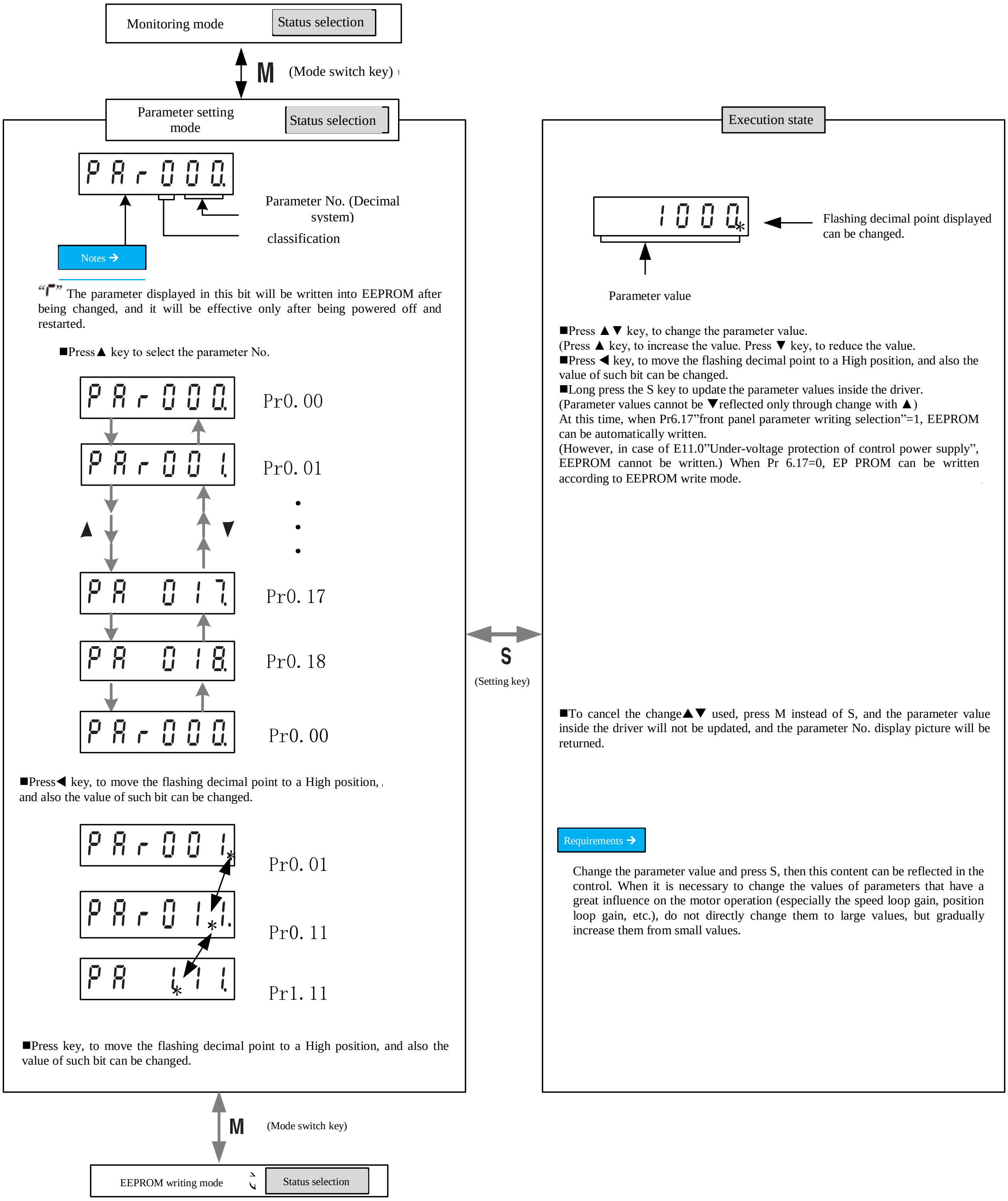


Figure 2.8.7-1 Parameter setting mode

Notes: After setting the parameters, refer to 2.15.2 "Contents of each mode" to return to the selection display. For the number of bits moving to High position, the parameters are limited.

2.8.8 EEPROM Write mode

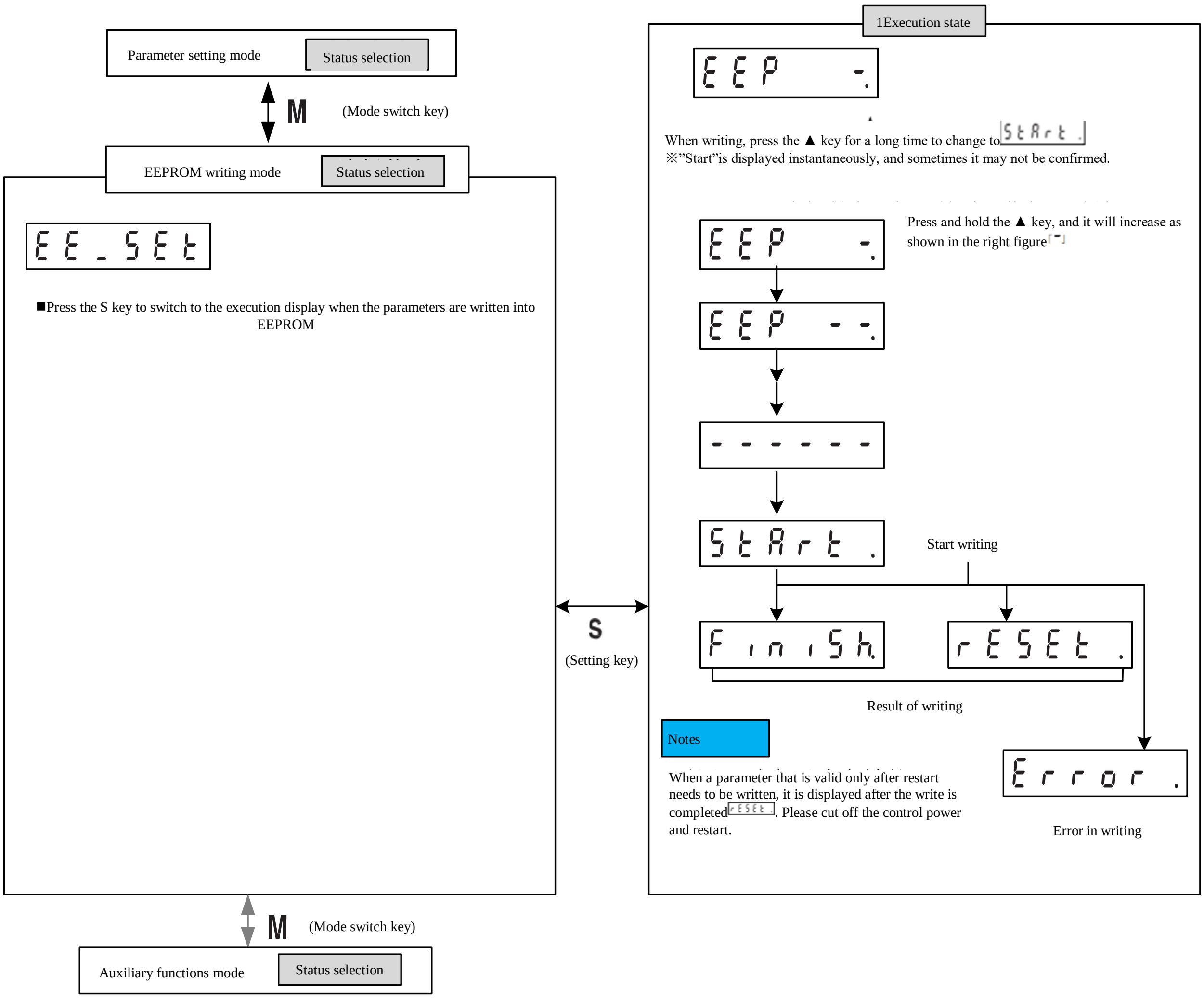


Figure 2.8.8-1 EEPEOM write mode

Note:

1. In case of error in writing, please write again. If a write error occurs repeatedly, it is necessary to consider this phenomenon as a failure.
2. Do not cut off the power when writing EEPROM. It is possible to write wrong data. If such error occurs actually,All parameters should be reset, and rewritten after full confirmation.
3. When ERR11.0 [undervoltage protection of control power supply] occurs Error., EEPROM writing cannot be performed.

2.8.9 Auxiliary function mode (selection state)

Select display: Select different function status display, and execute the display: press S setting key under the Select display status to realize different specific functions.

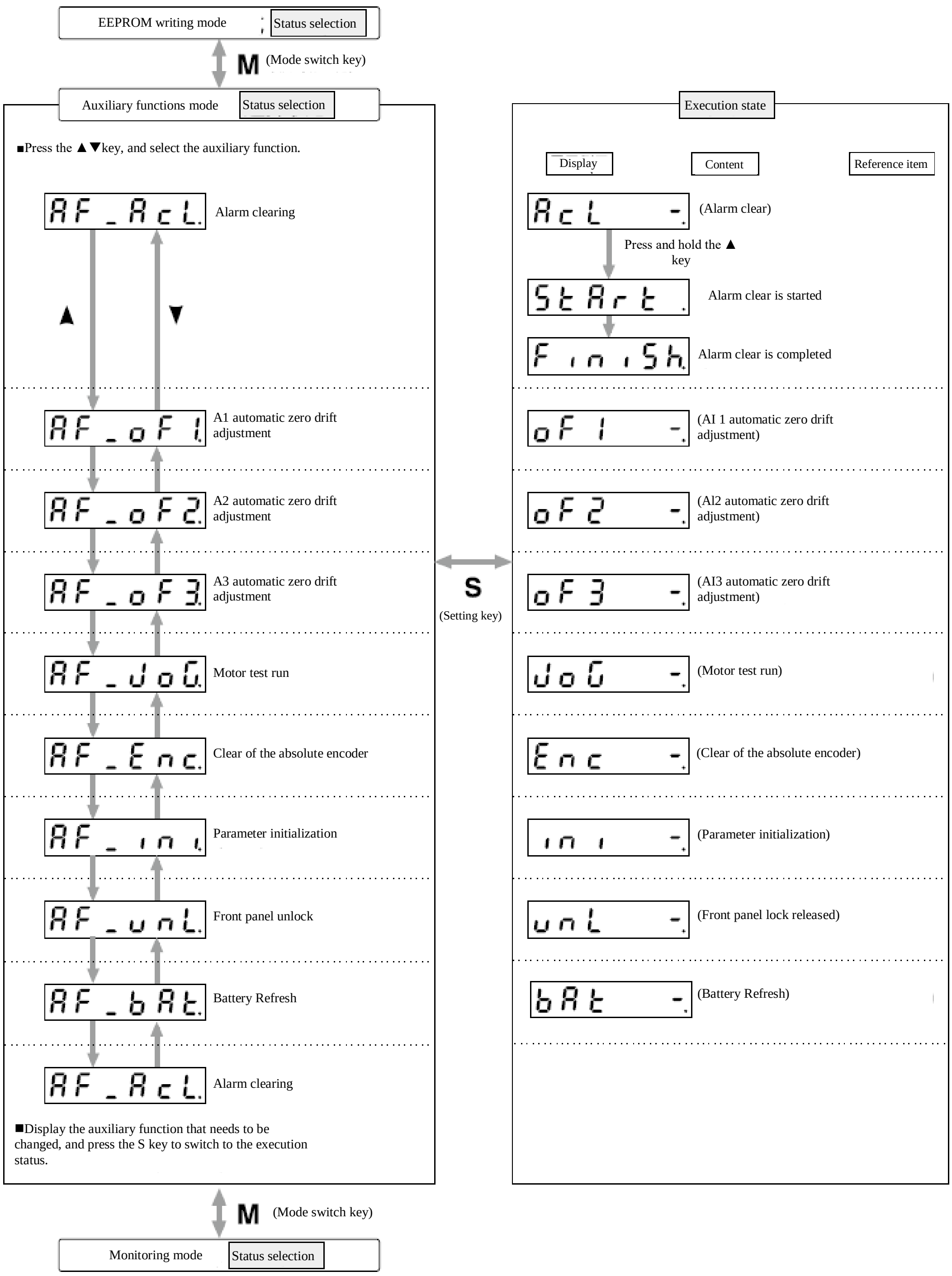


Figure 2.8.9-1 Auxiliary function mode

2.8.10 Auxiliary function mode (execution status)

1. Alarm clear screen
Release of the alarm occurrence status
There are cases where the alarm occurrence status cannot be released. Please refer to Section 6.3.1 for detailed contents.

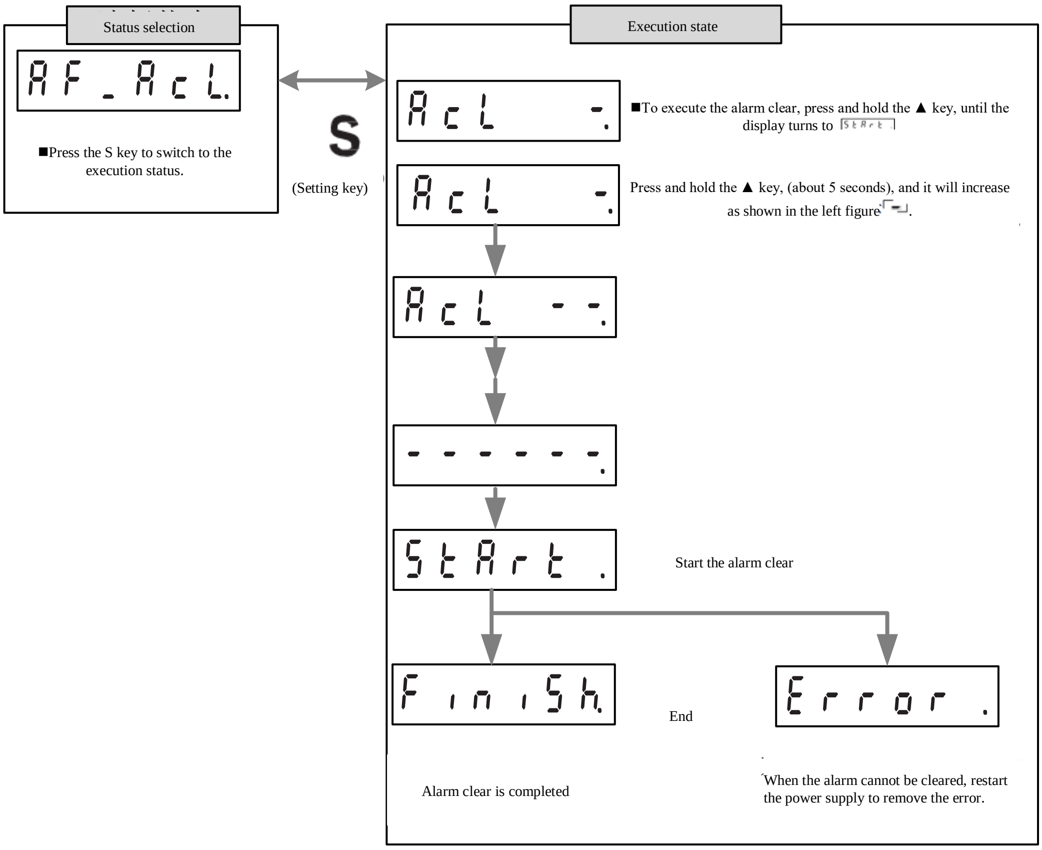


Figure 2.8.10-1 Alarm clear screen

Notes: After end of alarm clear, please refer to 2.8.2 "Contents of each mode" to return to the select display.

2. Analog input of 1~3 automatic zero drift adjustment
Automatically adjust the zero drift setting of analog input.
Analog input 1 (AI1) … Pr4.22 (analog input 1 zero drift setting)
Analog input 2 (AI2) … Pr4.25 (analog input 2 zero drift setting)
Analog input 3 (AI3) … Pr4.28 (analog input 3 zero drift setting)

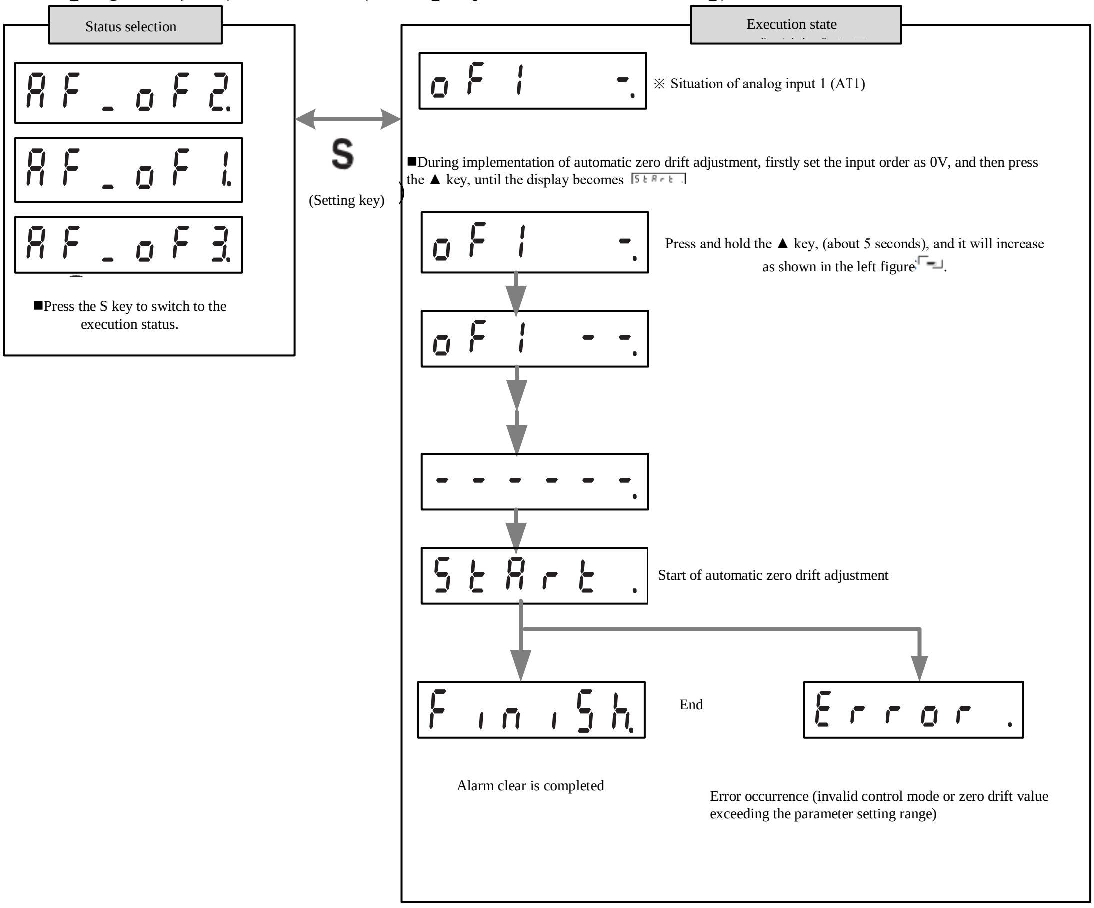


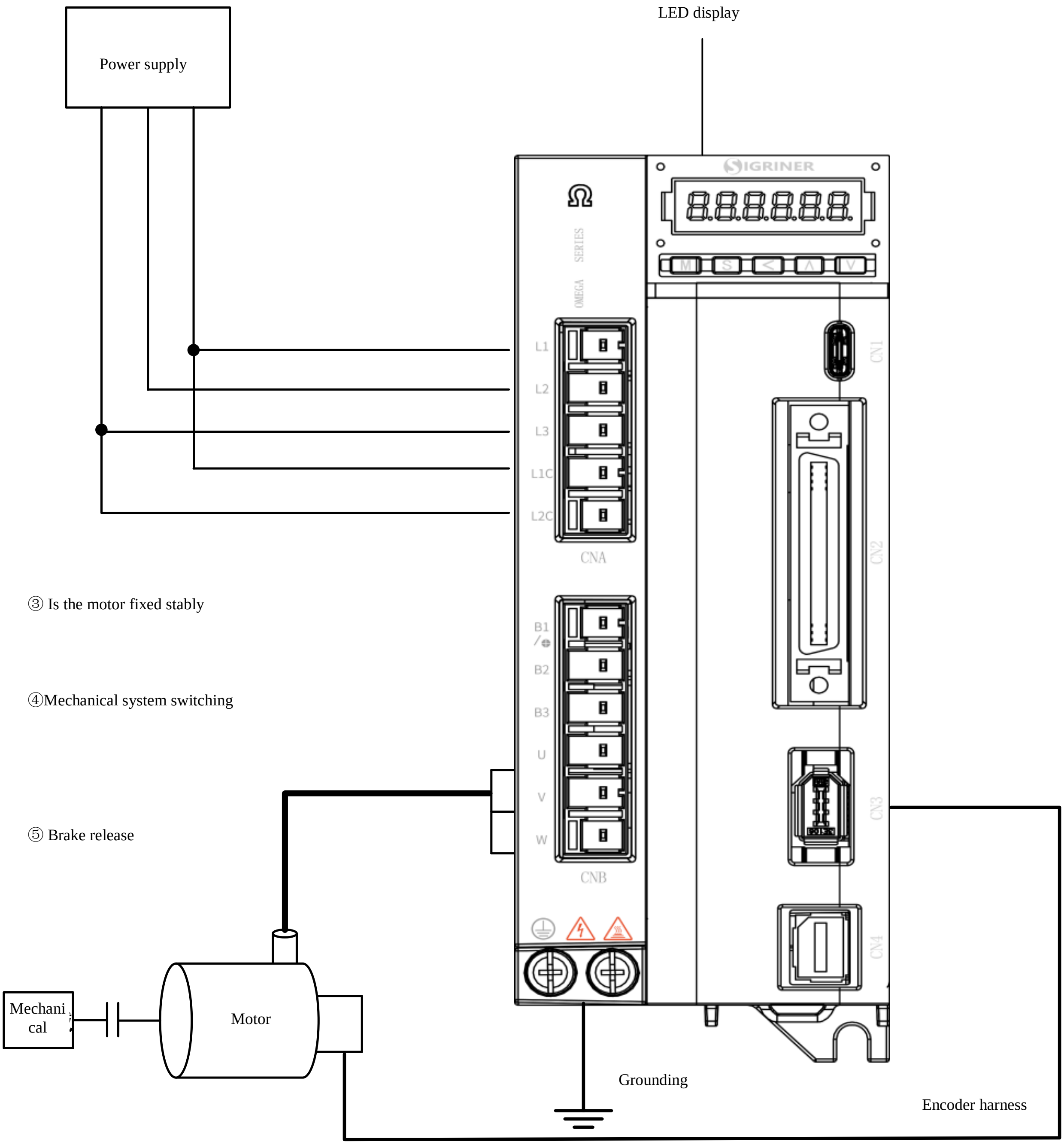
Figure 2.8.10-2 Automatic adjustment of the zero drift setting of analog input

Caution: Only automatic zero drift adjustment is performed, and data is not automatically written into EEPROM. Write to EEPROM if the zero drift adjustment function is required to take effect.
Notes: After end of automatic zero drift adjustment, please refer to 2.8.2 “Contents of each mode” to return to the select display.
3. Motor test run
Motor test run can be carried out in the state that the connector CN2 is not connected with the upper control devices such as PLC.
Requirement: Be sure to unload the motor and use it after removing the connector CN2
Please initialize the settings of user parameters (especially Pr0.04, Pr1.01~Pr1.04) to prevent occurrence of adverse phenomena like vibration.

4. Inspection before test run

① Wiring inspection
- Whether there is a wiring error (especially power input and motor output)
- Whether there is a circuit break, and confirm the ground wire
- Whether the connection part is loose

Confirmation of power supply voltage
- Whether the voltage is rated



⑥ At the end of the test run, please press the S key to turn off the servo

Figure 2.8.10-3 Test run

5.Test run process

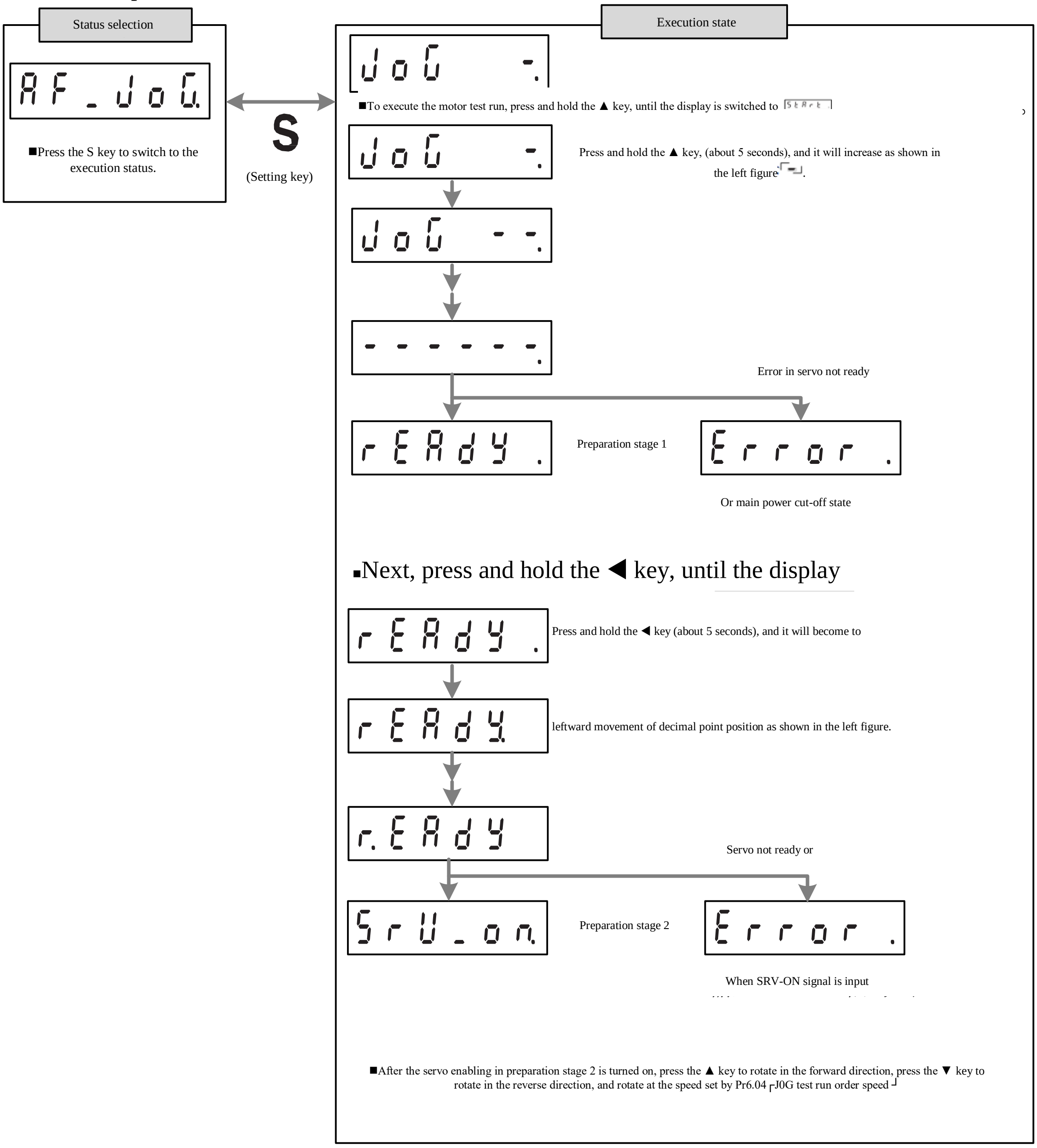


Figure 2.8.10-4 Test run process

Note:

1: During operation, please set the gain related parameters correctly to prevent vibration and other defects. Especially when there is no load, please set Pr0.04 “inertia ratio” as 0.

2: Test run is conducted in speed control mode. Please set various settings like parameters according to the normal operation under speed control.

SRV-ON is valid during the test run, which shows Error.; if the test run is interrupted in the middle, it will be acted by an external order.

3: After the end of motor test run, please refer to 2.8.2 “Contents of each mode” to return to the select display.

6. Clear of the absolute encoder

Clear multipleturn data and errors of the absolute encoder.

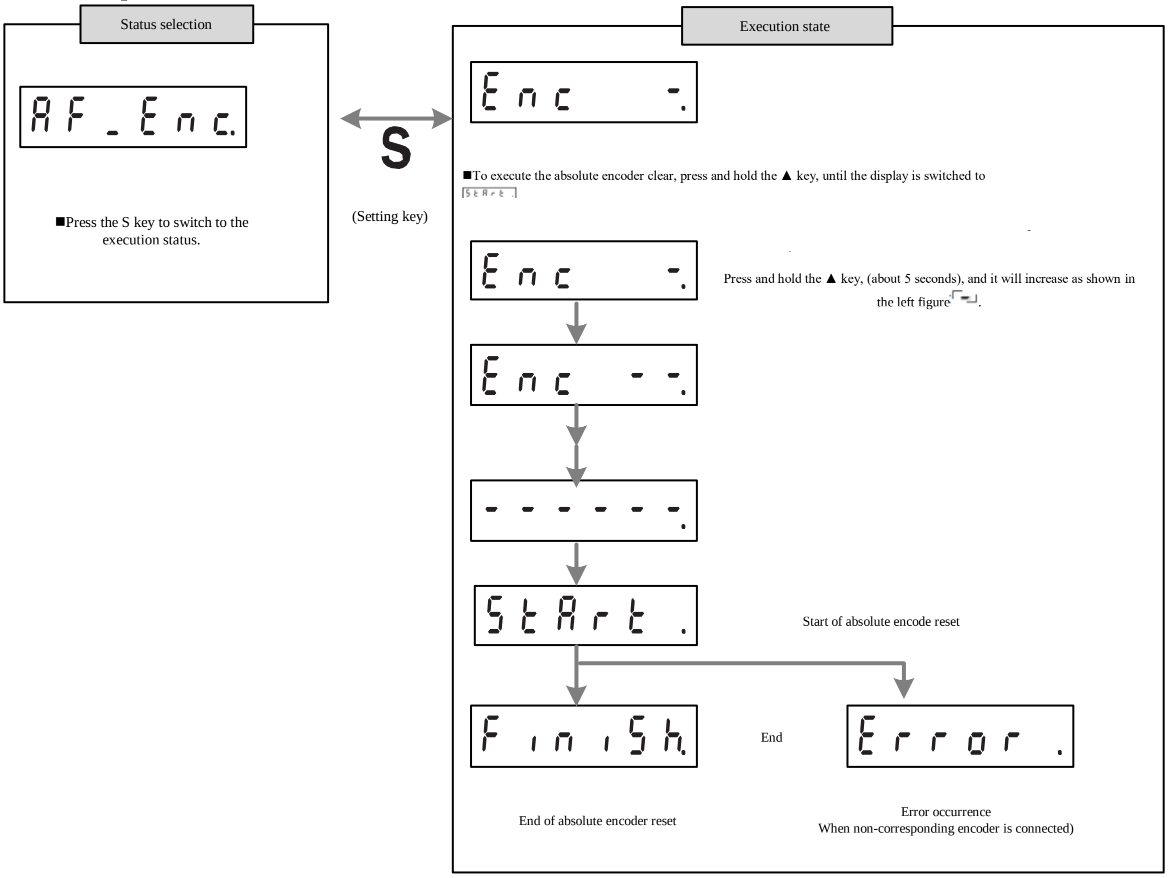


Figure 2.8.10-5 Clear of the absolute encoder

Note: After the end of absolute encoder, please refer to 2.8.2 “Contents of each mode” to return to the select status.

7. Parameter initialization

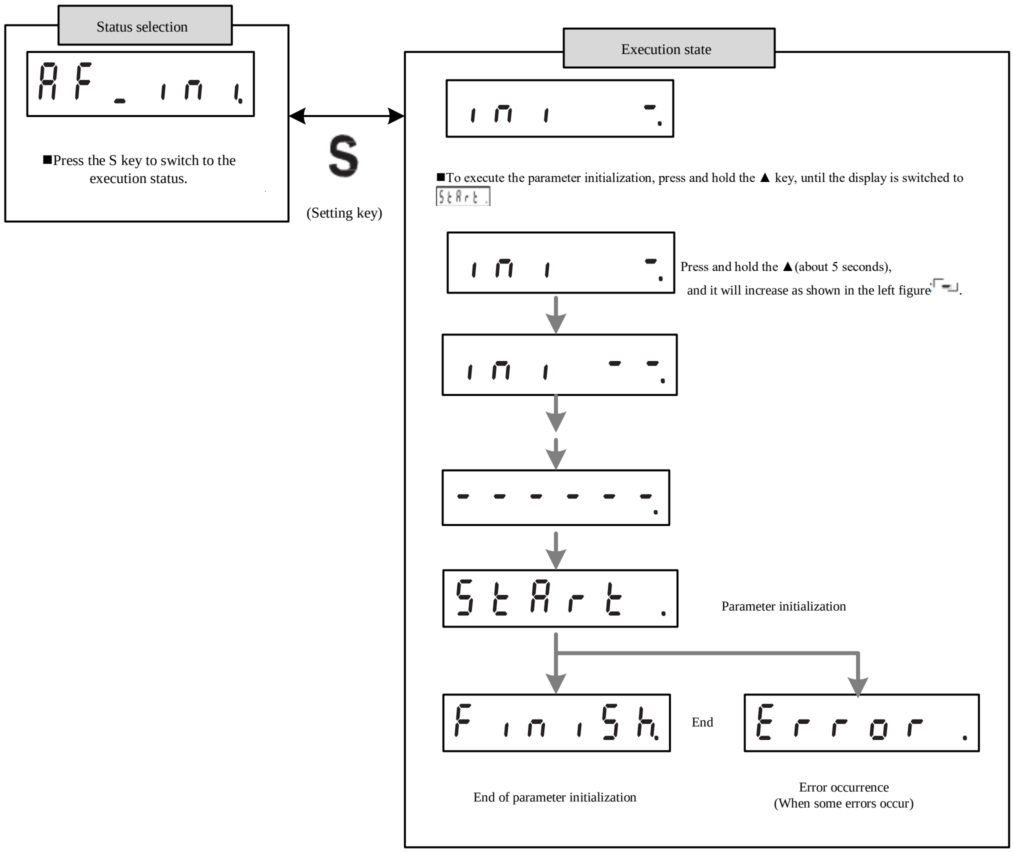


Figure 2.8.10-6 Parameter initialization

Note: In case of Err11.0 “Undervoltage protection of control power” or EEPROM-related errors (ERR 36.0, ERR 36.1, ERR 36.2, ERR 37.0, ERR 37.1, ERR 37.2), parameter initialization cannot be carried out, and “Error will be displayed”

Notes: After the end of parameter initialization, please refer to 2.8.2 “Contents of each mode” to return to the select display.

8. Front panel unlock

Release the front panel lock setting.

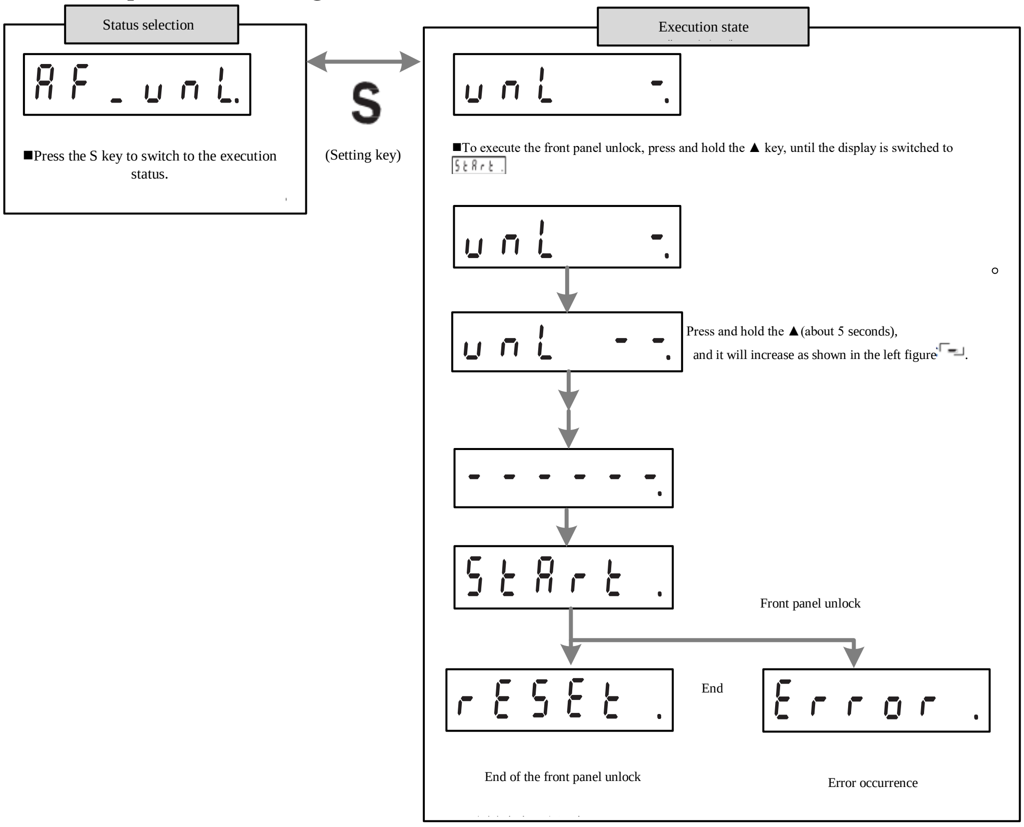


Figure 2.8.10-7 Front panel unlock

Note: After the front panel is unlocked, please refer to 2.8.2 “Contents of each mode” to return to the select status.

2.9 WIFI connection

2.9.1 WIFI installation

For WIFI wireless connection, the server must be plugged with a wireless WIFI module, and the installation interface is as follows:

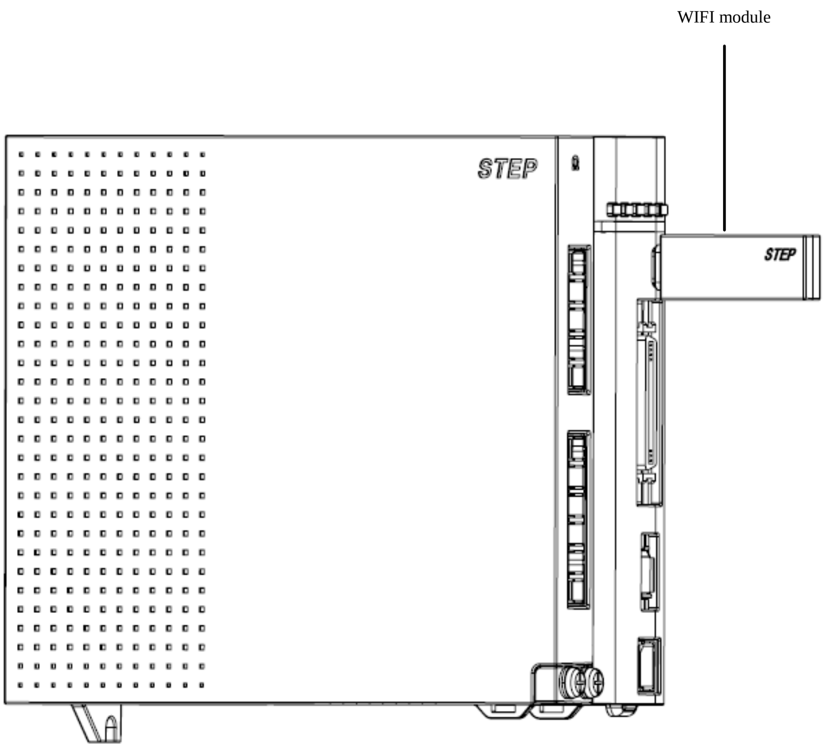


Figure 2.9.1-1 WIFI interface

2.9.2 Function introduction

There are two WIFI connection modes, namely AP mode and STA mode. AP mode is a hotspot provided by connecting mobile phones, PADs and PCs to a WiFi module, communicating point to point and realizing servo debugging; In STA mode, mobile phones, PADs and PCs are connected to the same wireless router on site, and data exchange is realized through the router.

2.9.3 Connection steps

1. AP mode
The WIFI module is in AP mode by default, and the upper computer can be used for connection debugging through connection to the WIFI hotspot “HF-LPT230”;
2.STA mode
Login WIFI hotspot, login WIFI IP address 10.10.100.254, enter the user name and password (admin by default), enter the mode setting interface to change the parameters:

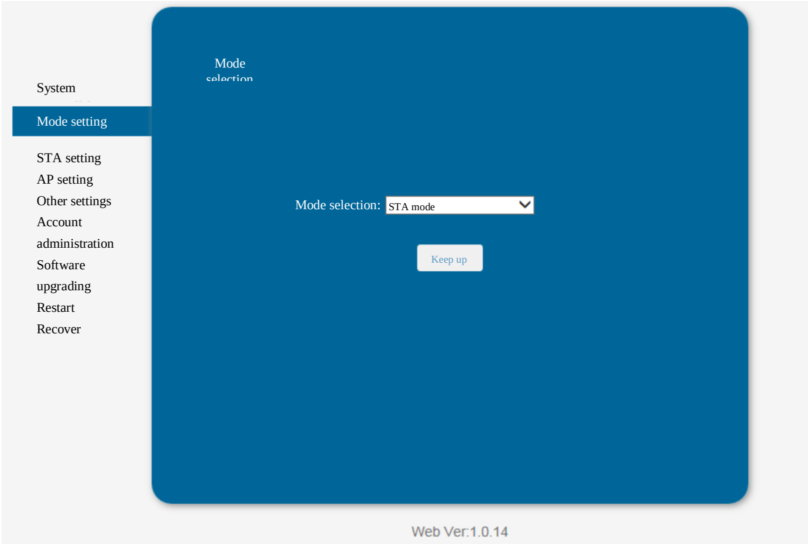


Figure 2.9.3-1 Mode selection

DTA mode is selected, and STA router is set:

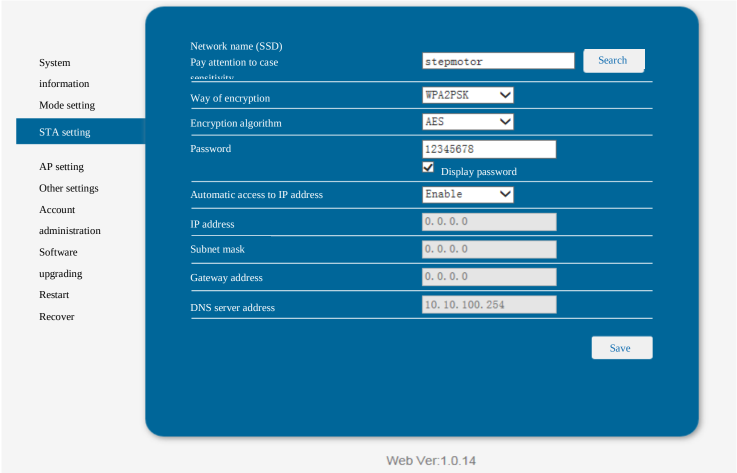


Figure 2.9.3-2 Router setup

Search and refresh, and select the router that needs to be connected.
In other settings:

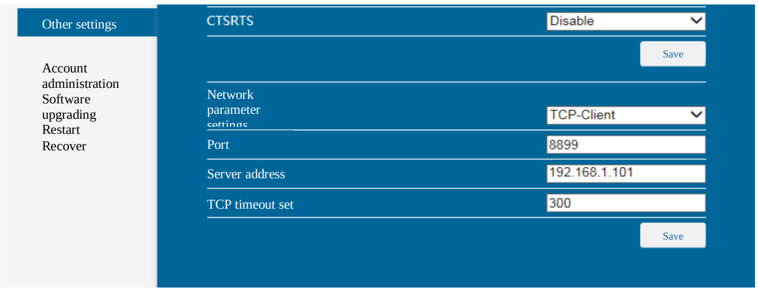


Figure 2.9.3-3 Other settings

In STA mode, WIFI module is generally used as client, so TCP-Client is selected for configuration. The corresponding “server address” in “other settings” of server address input interface is written as 192.168.1.101, and the parameters are saved to complete the restarting parameter configuration. Check whether the router is connected to the wireless module after configuration is completed. When DHCP server in the following figure has “HE-LPT230”, it indicates that a successful connection;

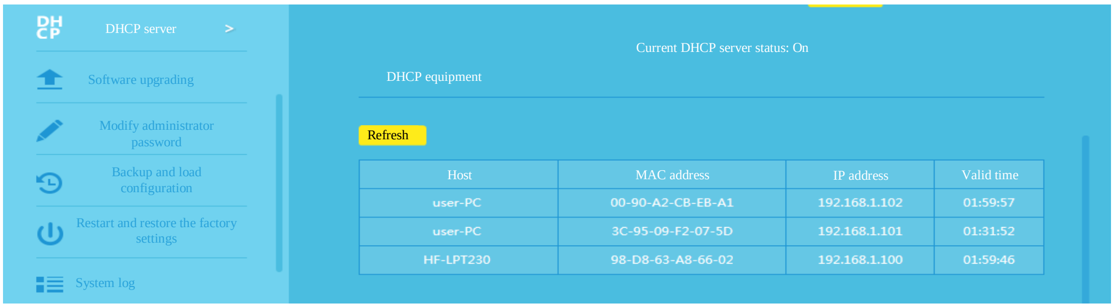


Figure 2.9.3-4 DHCP server

If switching to AP mode in STA mode, the IP address assigned to wifi by the login router is 192.168.1.100 above, it is just required to change the mode parameter AP.

2.10 Outline of control mode

2.10.1 Position control mode

1. Summary

Position control is performed based on a position order (pulse train) input from the upper controller. The following describes [illegible]ings for position control.

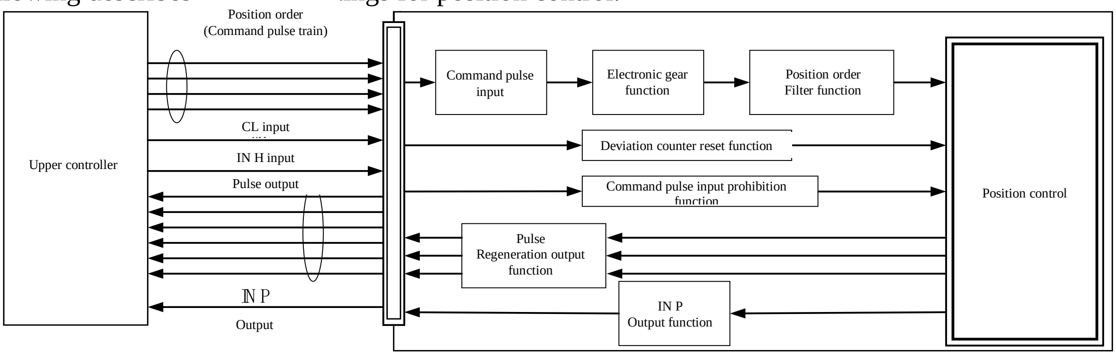


Figure 2.10.1-1 Basic setting of controller input

2. Function

① Process of command pulse input

The position command (pulse train) corresponds to the following three types of inputs.

・Two-phase orthogonal pulse

・Positive pulse/negative pulse

・Pulse train ＋sign

According to the upper controller specifications and the servo settings, set the pulse shape and pulse counting mode.

Pulse input signals are divided into two types according to actual needs:

Input 1:”PULSH1, PULSH2, SIGNH1, SIGNH2” line receiver input (8Mpulse/s)

Input 2:”PULS1, PULS2, SIGN1, SIGN2” photocoupler input (500 kpulse /s)

Caution: During differential input,”input 2”also can be used, but the highest input frequency is unchanged.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Function
Pr0.05	Command pulse input selection	0～2	Select one of the photocoupler input and the long line driver input as the command pulse input. 0: Photocoupler input (PULS1, PULS2, SIGN1, SIGN2) 1: Dedicated input for long line driver (PULSH1, PULSH2, SIGNH1, SIGNH2) 2: Photocoupler input (PULS1, PULS2, SIGN1, SIGN2)
Pr0.06	Command pulse rotation direction setting	0～1	Set the command pulse input counting direction.
Pr0.07	Command pulse input mode setting	0～3	Set the command pulse input mode

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

② Electronic gear function

The function of giving the value multiplied by the pulse command input by the upper controller and the set frequency division ratio to the position loop as the position command for position control. With this function, the rotation and movement of the motor of unit input command pulse can be arbitrarily set.

When the upper controller pulse output ability is insufficient, leading to the motor can not reach the desired speed, this function can be used to increase the pulse command frequency.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Function
Pr0.08	Number of command pulses per revolution	0～16777216	Set the number of command pulses per revolution.
Pr0.09	#1 command frequency division/multiplication numerator	0～1073741824	Set the numerator of the frequency division/multiplication processing of corresponding command pulse input.
Pr0.10	Command frequency division/multiplication denominator	1～1073741824	Set the denominator of the frequency division/multiplication processing of corresponding command pulse input.

Notes: Please refer to Chapter 4 “Parameter setting”for the detailed contents of parameters above.

③ Position command filter function

To smooth the position command after frequency division/multiplication (electronic gear), a command filter should be set.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Unit	Function
Pr2.22	Command smoothing filter	0～1000	ms	Set the time constant of the primary delay filter corresponding to the position command.
Pr2.23	Command FIR filter	0～1000	ms	Set the time constant of FIR filter of corresponding position command.

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

④ Pulse regenerationfunction

The amount of movement can be transmitted from the servo driver to the upper controller in the AB phase pulse mode. The z-phase signal is output once for every revolution of the motor. Output resolution and phase B logic can be set with parameters.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Unit	Function
Pr0.11	Number of pulses per revolution	1～2097152	P/r	The pulse output resolution is set by the number of pulses output by OA and OB per revolution.
Pr0.12	Pulse output logic inversion/output source selection	0～3	—	Set the phase B logic and output source of pulse output. According to this parameter, the phase relationship between the phase A pulse and the phase B pulse can be reversed by reversing the b-phase pulse.
Pr5.03	Pulse output frequency division denominator	0～16777216	—	If the number of output pulses per revolution is not an integer, it is required to set it as a value other than 0, and set the frequency division ratio with Pr0.11 as the numerator and Pr5.03 as the denominator.
Pr5.33	Effective setting of pulse regeneration output limit	0～1	—	Set the error detection (Err28.0”pulse regeneration output limit protection) to be valid/invalid.

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

⑤ Deviation counter clear function

This function is to reset the value of the position deviation counter of position control through the deviation counter clear input (CL).

●Relevant parameters

Parameter No.	Parameter name	Setting range	Function
Pr5.17	Counter clear input mode	0～4	Set the clearing condition of the deviation counter clear input signal.

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

⑥ Positioning end output (INP) function

The positioning end state can be confirmed by positioning end output (INP). Under position control, the absolute value of the position deviation counting value becomes ON when it is below the positioning end range set by the parameters. In addition, the presence or absence of the position command can be added to the determination condition.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Unit	Function

Pr4.31	Positioning end range	0～2097152	Command unit	Set the time of positional deviation of the output positioning end signal (INP1).
Pr4.32	Position end output setting	0～10	—	Select the output condition of the positioning end signal (INP1).
Pr4.33	INP retention time	0～30000	1ms	Set the retention time when Pr4.32 “positioning end output setting” =3.
Pr4.42	Positioning end range 2	0～2097152	Command unit	Set the dynamics of position deviation of the output positioning end signal 2 (INP2).

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

⑦ Command pulse inhibition (INH) function

Through the command pulse inhibition input signal (INH), the processing of the command pulse counter can be forcibly stopped. When INH input is ON,the servo driver ignores the command pulse input and no pulse counting is conducted.

This function is invalid in the default setting. During the use, please change the setting of Pr5.18”command pulse prohibition input invalid”.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Function
Pr5.18	Command pulse input mode invalid setting	0～1	Set the command pulse prohibition input valid/invalid.
Pr5.19	Command pulse prohibition input read setting	0～5	Select the signal read cycle of command pulse prohibition input. When the signal state of each set read cycle is consistent with the complex number of times, the signal state should be updated.

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

2.10.2 Speed control mode

1. Outline

Speed control according to the analog speed command input by the upper controller or the internal speed instruction set inside the servo driver.

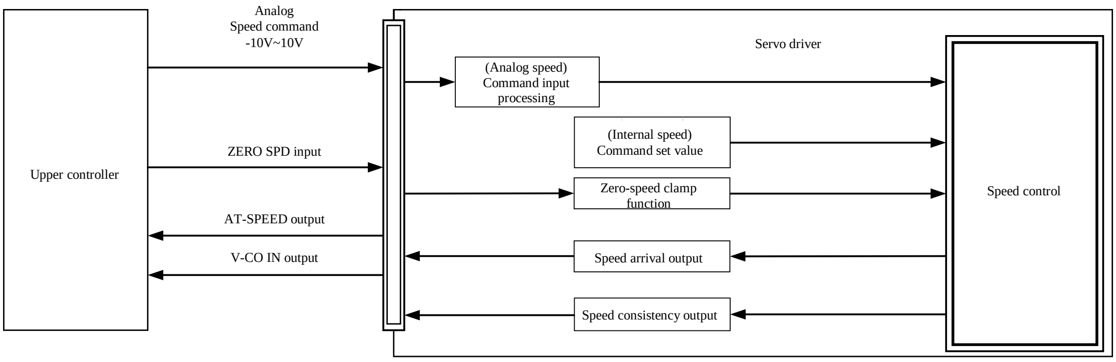


Figure 1.10.2-1 Speed control mode

2. Function

(1) Speed control by analog speed command

The Analog speed command input (voltage) is AD converted to obtain digital value, which will be converted into speed command value. In order to remove the command noise, a filter can be set and zero-drift adjustment can be performed.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Unit	Function
Pr3.00	Switching beyond the speed setting	0～3	—	Select the speed command input mode in the speed control mode.
Pr3.01	Speed command direction Specified selection	0～1	—	Select the method of specifying the positive direction/negative direction of the speed command.

Pr3.02	Speed command input gain	10～2000	(r/min)/V	Set the conversion gain of applying the voltage from the analog speed command (SPR) to the motor speed command.
Pr3.03	Speed command input Reverse rotation	0～1	—	Set the polarity of voltage applied onto the analog speed command (SPR).
Pr4.22	Analog input 1 (AI1) Zero drift setting	-5578～5578	0.001V	Set the zero drift adjustment value of the voltage applied to the analog input 1.
Pr4.23	Analog input 1 (AI1) Filter setting	0～64000	0.01ms	Set time constant One-time delay filter for voltage applied to analog input 1

Notes: Please refer to Chapter 4"Parameter setting"for the detailed contents of parameters above.

(2) Speed control through internal speed command

Speed control is performed based on the internal speed command values set to the parameters. By using internal command speed selection 1～3 (INTSPD1～3), a selection can be made from a maximum of 8 internal speed command settings. Default setting is analog speed command setting. Use by changing Pr3.00 "Speed setting internal/ external switching" to internal speed setting.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Unit	Function
Pr3.00	Switching beyond the speed setting	0～3	—	Select the speed command input mode in the speed control mode
Pr3.01	Speed command direction Specified selection	0～1	—	Select the method of specifying the positive direction/negative direction of the speed command
Pr3.04	Speed setting 1st speed	-20000～20000	r/min	Set the 1st speed of internal command speed
Pr3.05	Speed setting 2nd speed			Set the 2nd speed of internal command speed
Pr3.06	Speed setting 3rd speed			Set the 3rd speed of internal command speed
Pr3.07	Speed setting 4th speed			Set the 4th speed of internal command speed
Pr3.08	Speed setting 5th speed			Set the 5th speed of internal command speed
Pr3.09	Speed setting 6th speed			Set the 6th speed of internal command speed
Pr3.10	Speed setting 7th speed			Set the 7th speed of internal command speed
Pr3.11	Speed setting 8th speed			Set the 8th speed of internal command speed

Notes: Please refer to Chapter 4"Parameter setting"for the detailed contents of parameters above.

(3) Zero-speed clamp (ZEROSPD) function

Use the zero speed clamp input, to forcibly set the speed command as 0.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Unit	Function
Pr3.15	Zero-speed clamp function Selection	0～3	—	Set zero-speed clamp function.
Pr3.16	Zero-speed clamp grade	10～20000	r/min	Set the time to switch to position control when Pr3.15 "zero speed clamp function selection" is 2 or 3.

Notes: Please refer to Chapter 4"Parameter setting"for the detailed contents of parameters above

(4) Speed arrival output (AT-SPEED)

When the motor speed reaches the speed set in Pr4.36 "Arrival Speed", speed arrival output (AT-SPEED) signal is output.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Unit	Function

Pr4.36	Arrival speed	10～20000	r/min	Set the time for testing the speed arrival output (AT-SPEED).

Notes: Please refer to Chapter 4"Parameter setting"for the detailed contents of parameters above

(5) Speed consistency output (V-COIN)

Output when the speed command (before acceleration and deceleration) is consistent with the motor speed. When the difference between the speed command before acceleration/deceleration in the driver and the motor speed is within Pr4.35 "Speed consistency width", it will be regarded as consistent.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Unit	Function
Pr4.35	Speed consistency width	10～20000	r/min	Set the time for testing the speed consistency output (V-COIN).

Notes: Please refer to Chapter 4"Parameter setting"for the detailed contents of parameters above

(6) Speed command acceleration/deceleration setting function

For speed command input, the acceleration and deceleration settings in the driver are used as speed commands for speed control.

In addition, to reduce the impact through the change of acceleration, S-shaped acceleration and deceleration function can be used.

●Relevant parameters

Parameter No.	Parameter name	Setting range	Unit	Function
Pr3.12	Acceleration time setting	0～10000	Ms/ (1000r/min)	Set the acceleration time of the acceleration processing corresponding to the speed instruction input.
Pr3.13	Acceleration time setting	0～10000	Ms/ (1000r/min)	Set the deceleration time of the deceleration processing corresponding to the speed instruction input.
Pr3.14	S-shaped acceleration setting	0～1000	ms	Set the S-shaped time corresponding to the speed instruction input.

Notes: Please refer to Chapter 4"Parameter setting"for the detailed contents of parameters above

TIPS Attention: Do not use acceleration and deceleration time when a position ring is formed outside the driver. Please set all the above parameters to 0 for use.

2.10.3 Torque control mode

1. Outline

Torque control is performed in accordance with the torque command specified by the analog voltage. During the torque control, a speed limit is required to be input in addition to the torque command, to control the motor rotation speed within the range of the speed limit value.

There are 3 modes depending on different input methods of torque command/speed limit.

Various modes are shown as below.

● Pr3.17"Torque command selection"

Set value		Torque command input	Speed limit input
0	Torque command selection 1	Analog input 1	Reference value (Pr3.21)
1	Torque command selection 2	Analog input 2	Analog input 1
2	Torque command selection 3	Analog input 1	Reference value (Pr3.21, Pr3.22)

< Torque command selection 1, 3 >

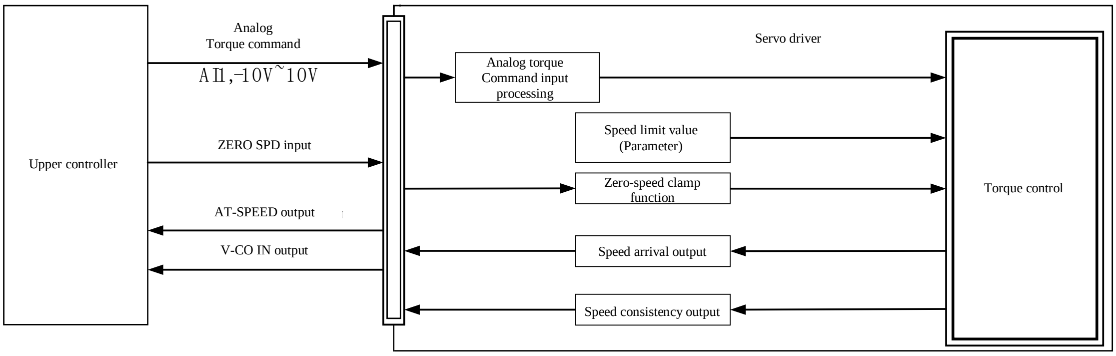


Figure 2.10.3-1 Torque command selection 1,3

<Torque command selection 2>

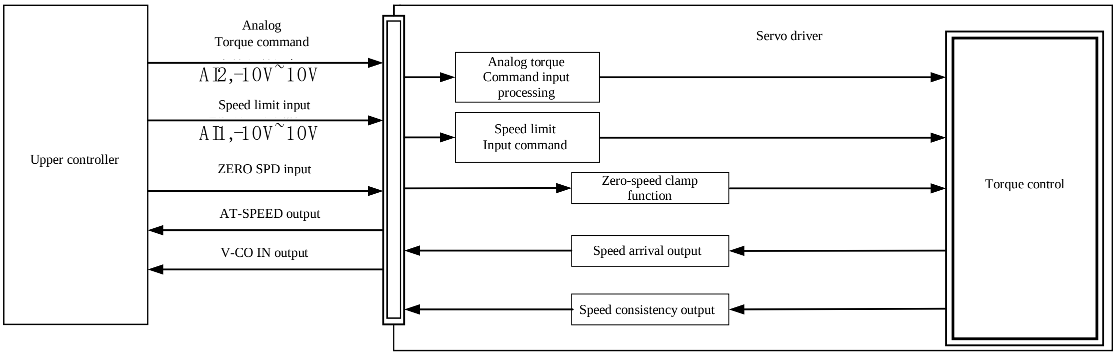


Figure 2.10.3-2 Torque command selection 2

2. Function

(1) Analog torque command input treatment

Analog torque command input (voltage) is AD converted to obtain a digital value, which will be converted into torque command value. In order to remove the noise, a filter can be set and zero-drift adjustment can be made.

●Relevant parameters＜Torque command selection 1, 3＞

Parameter No.	Parameter name	Setting range	Unit	Function
Pr3.18	Torque command direction Specified selection	0～1	—	Select the method of specifying the positive direction/negative direction of the torque command
Pr3.19	Torque command input gain	10～100	0.1V/100%	Set the conversion gain from the voltage [V] applied to the analog torque command (TRQR) to the torque command [%].
Pr3.20	Torque command input Reverse rotation	0～1	—	Set the polarity of voltage applied onto the analog torque command (TRQR).
Pr4.25	Analog input 2 (AI2) zero drift setting	-5578～5578	0.001V	Set the zero drift adjustment value of the voltage applied to the analog input 2.
Pr4.26	Analog input 2 (AI2) filter setting	0～6400	0.01ms	Set the time constant of the 1st order delay filter applied to the analog input 2 voltage.

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

●Relevant parameters＜Torque command selection 2＞

Parameter No.	Parameter name	Setting range	Unit	Function
Pr3.18	Torque command direction Specified selection	0～1	—	Select the method of specifying the positive direction/negative direction of the torque command
Pr3.19	Torque command input	10～100	0.1V/100%	Set the conversion gain from the voltage [V] applied to the analog torque command (TRQR) to the torque

	gain			command [%].
Pr3.20	Torque command input Reverse rotation	0∽1	—	Set the polarity of voltage applied onto the analog torque command (TRQR).
Pr4.25	Analog input 2 (AI2) zero drift setting	-5578∽5578	0.001V	Set the zero drift adjustment value of the voltage applied to the analog input 2.
Pr4.26	Analog input 2 (AI2) filter setting	0∽6400	0.01ms	Set the time constant of the 1st order delay filter applied to the analog input 2 voltage.

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

(2) Speed limit function

Speed limitation is performed as a protection during torque control.

During the torque control, the speed is controlled within a range smaller than the speed limit value.

TIPS Attention: During the speed limit control, the torque command received by the motor is not executed according to the input analog torque command. When the motor speed reaches the speed limit, the motor speed will be controlled as the speed limit.

●Relevant parameters < Torque command selection 1.3 >

Parameter No.	Parameter name	Setting range	Unit	Function
Pr3.21	Speed limit value 1	0∽20000	r/min	Set the speed limit value during torque control.
Pr3.22	Speed limit value 2	0∽20000	r/min	Set the speed limit value during torque control.
Pr3.15	Zero-speed clamp function Selection	0∽3	—	Set zero-speed clamp function.

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

●Relevant parameters < Torque command selection 2 >

Parameter No.	Parameter name	Setting range	Unit	Function
Pr3.02	Speed command input gain	10∽2000	(r/min)/V	Set the conversion gain from the voltage applied to the analog speed limit input (SPL) to the speed limit value [%].
Pr4.22	Analog input 1 (AI1) zero drift setting	-5578∽5578	0.001V	Set the zero drift adjustment value of the voltage applied to the analog input 1.
Pr4.23	Analog input 1 (AI1) filter setting	0∽6400	0.01ms	Set the time constant of the 1st order delay filter applied to the analog input 1 voltage.
Pr3.15	Zero-speed clamp function Selection	0∽3	—	Set zero-speed clamp function.

Notes: Please refer to Chapter 4”Parameter setting”for the detailed contents of parameters above.

2.11 Control block diagram

2.11.1 Position control mode

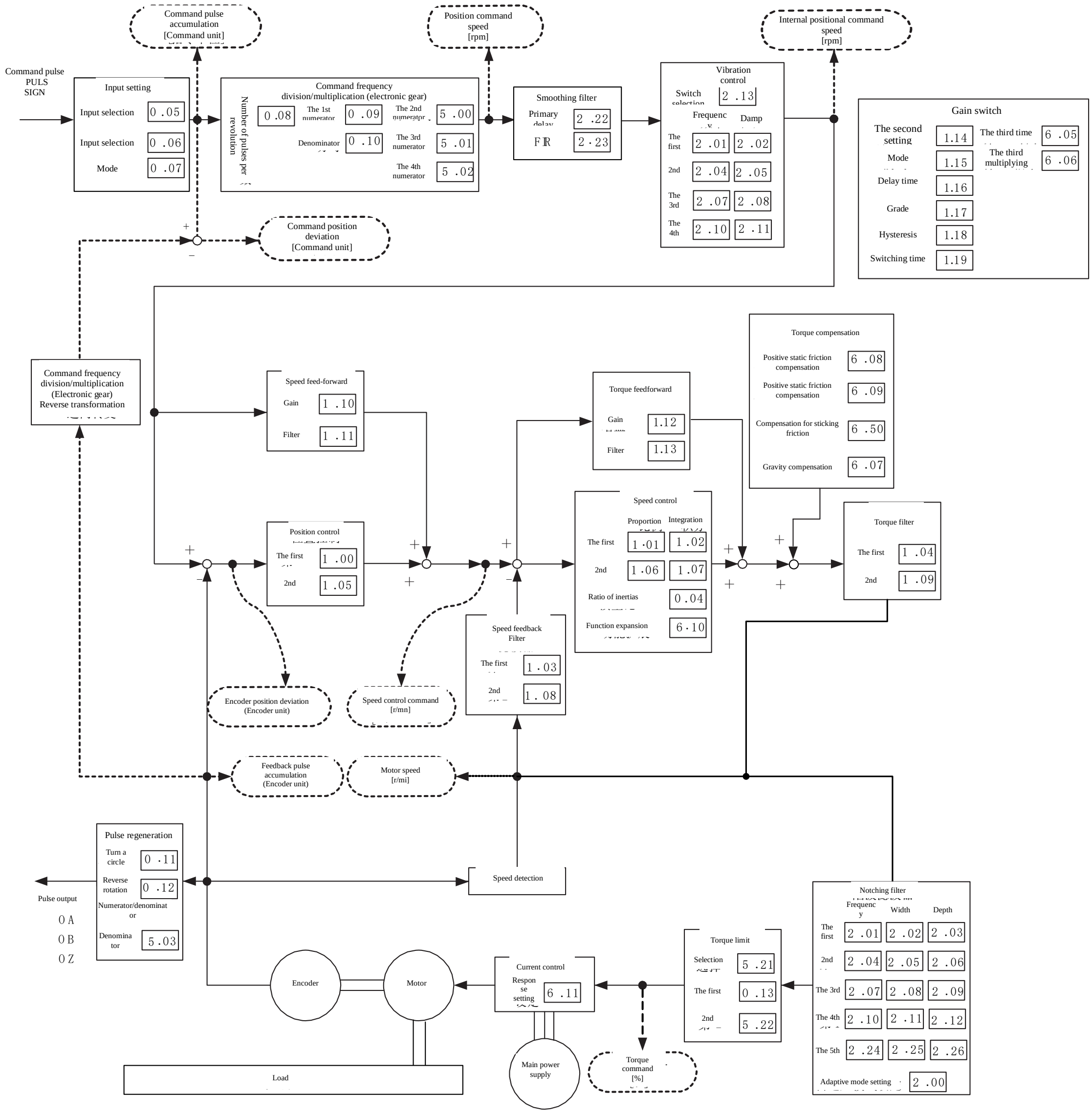


Figure 2.11.1-1 Position control mode

2.11.2 Speed control mode

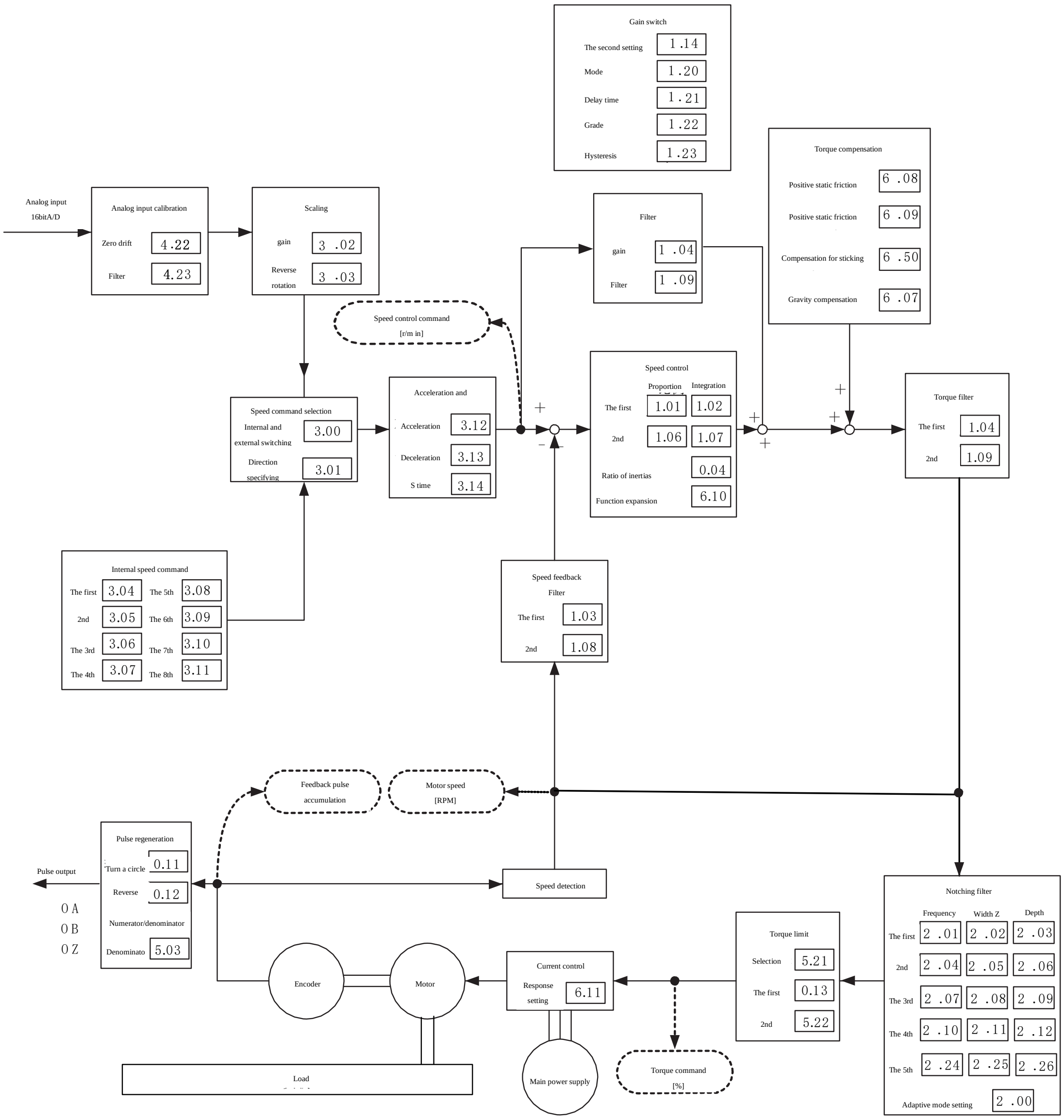


Figure 2.11.2-1 Speed control mode

2.11.3 Torque control mode

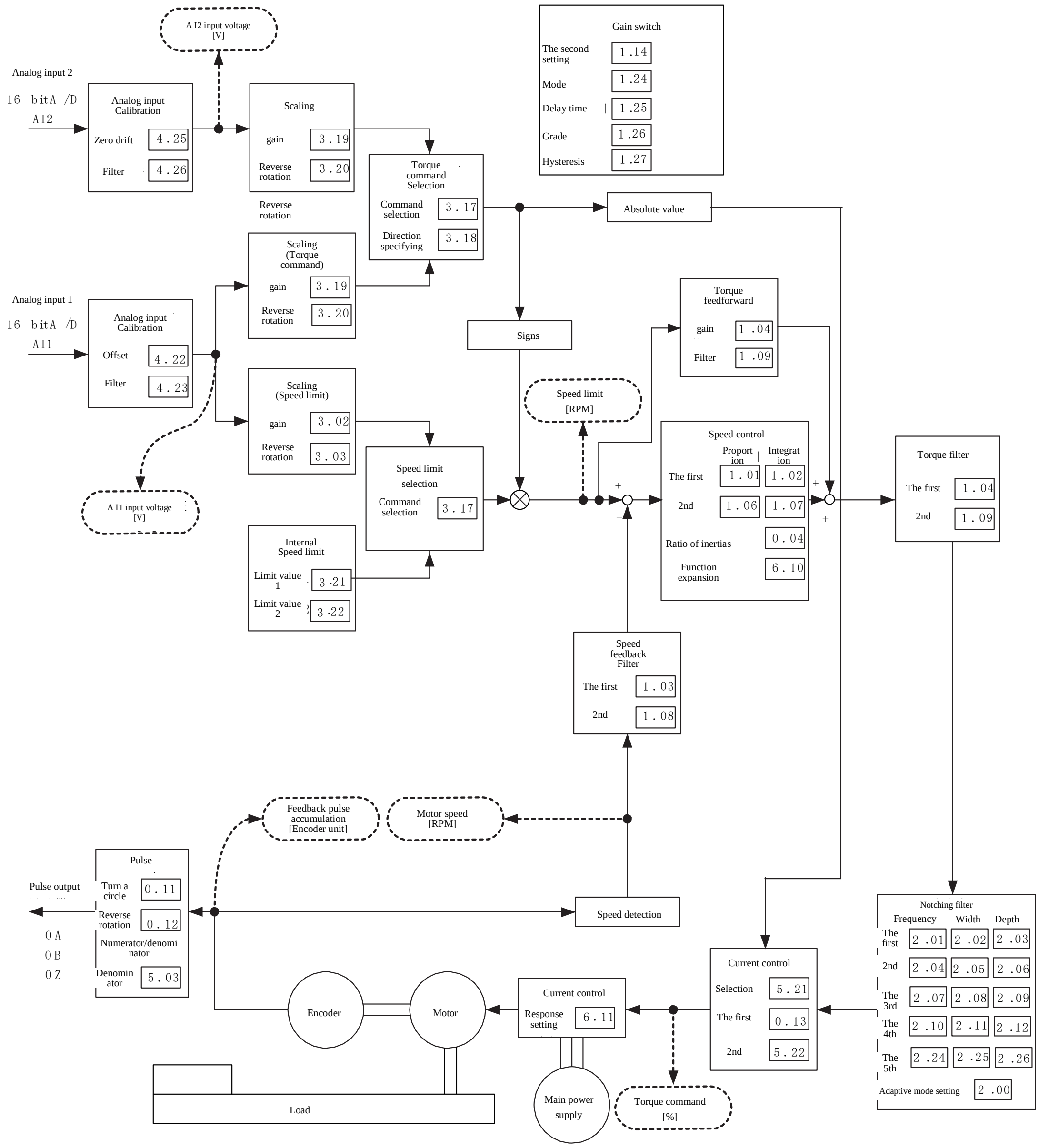


Figure 2.11.3-1 Torque control mode

2.12 Connector CN2 wiring diagram

2.12.1 Wiring example of each control mode

Position control mode:

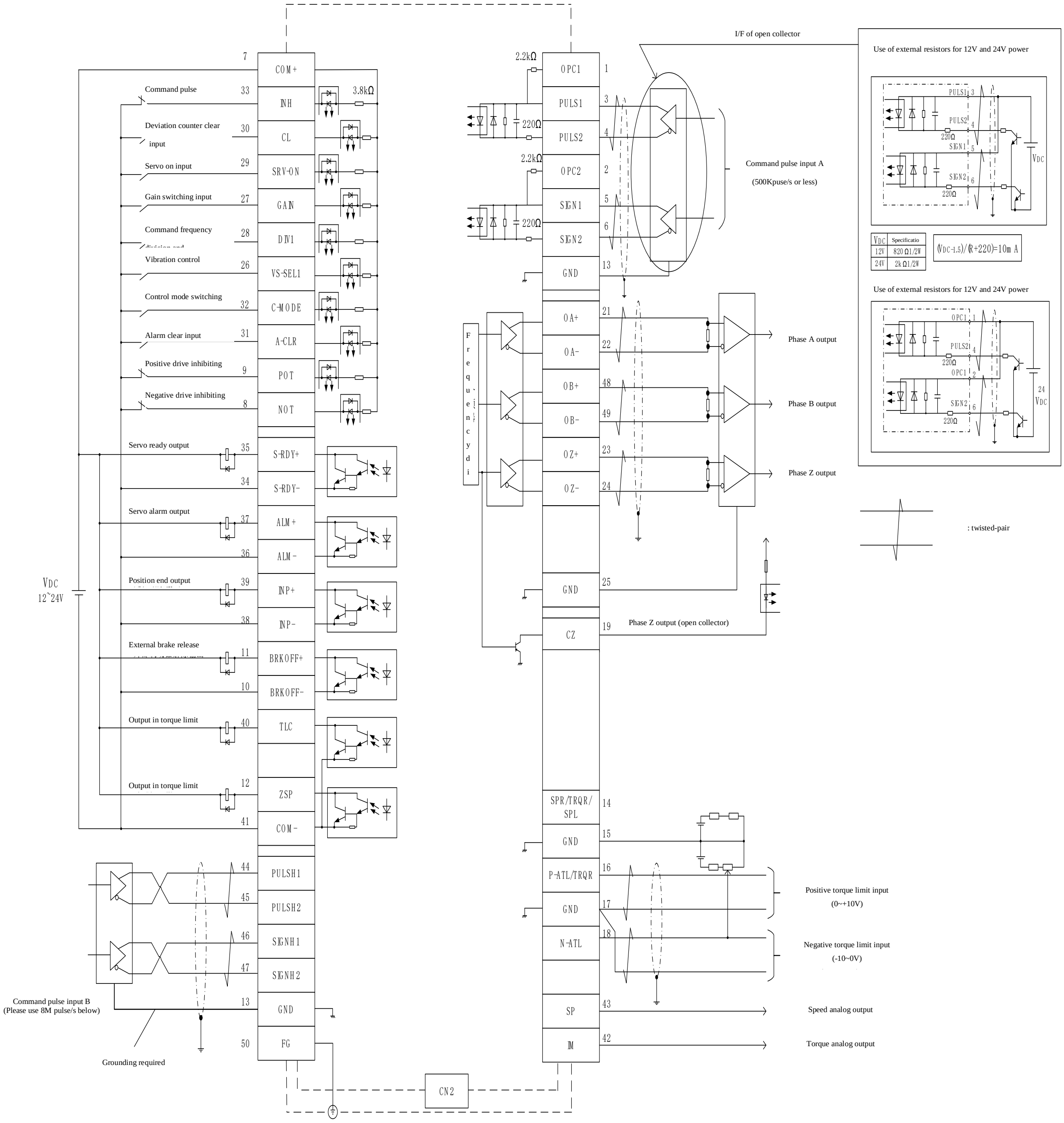


Figure 2.12.1-1 Position control mode

Speed control mode:

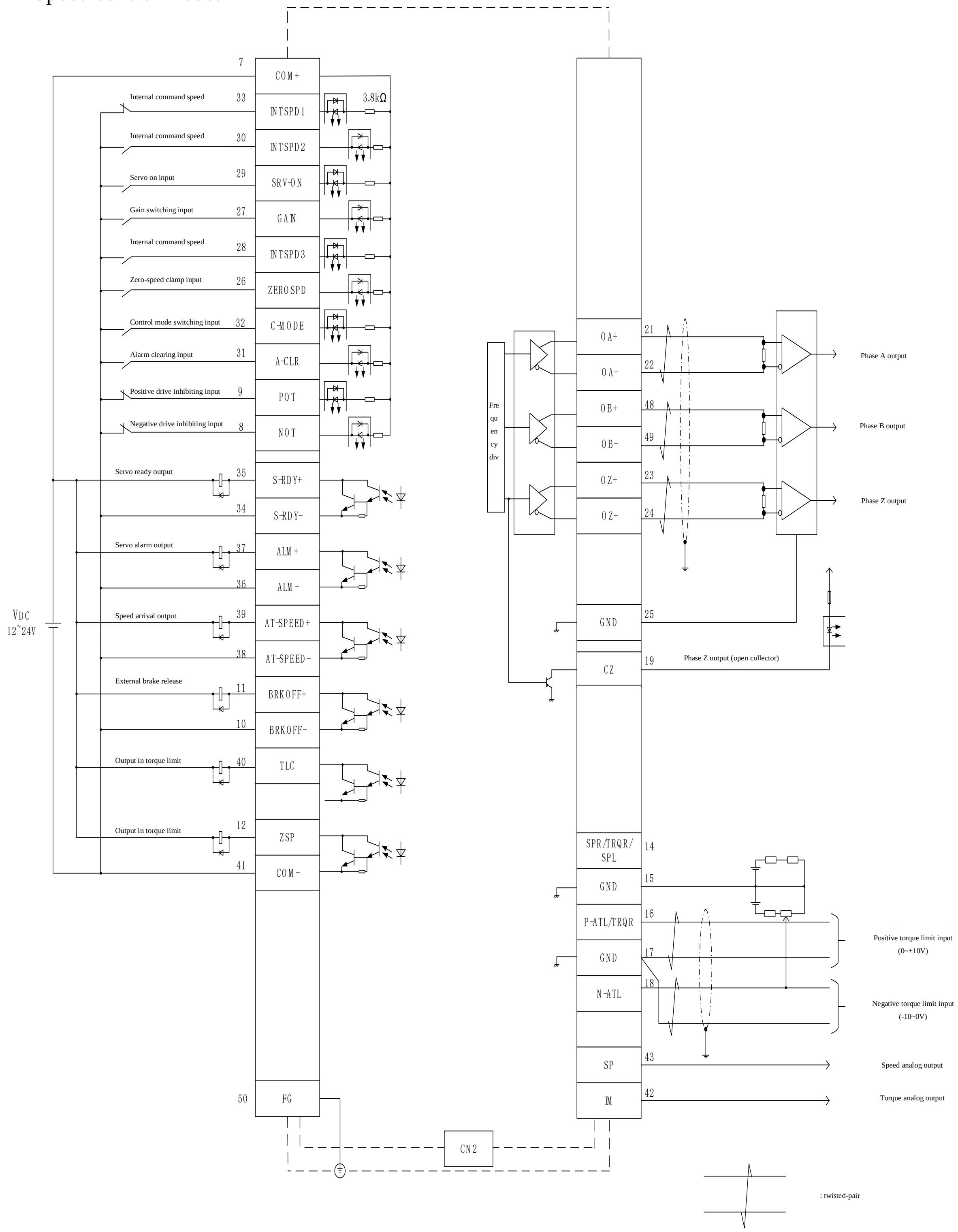


Figure 2.12.1-2 Speed control mode

Torque control mode:

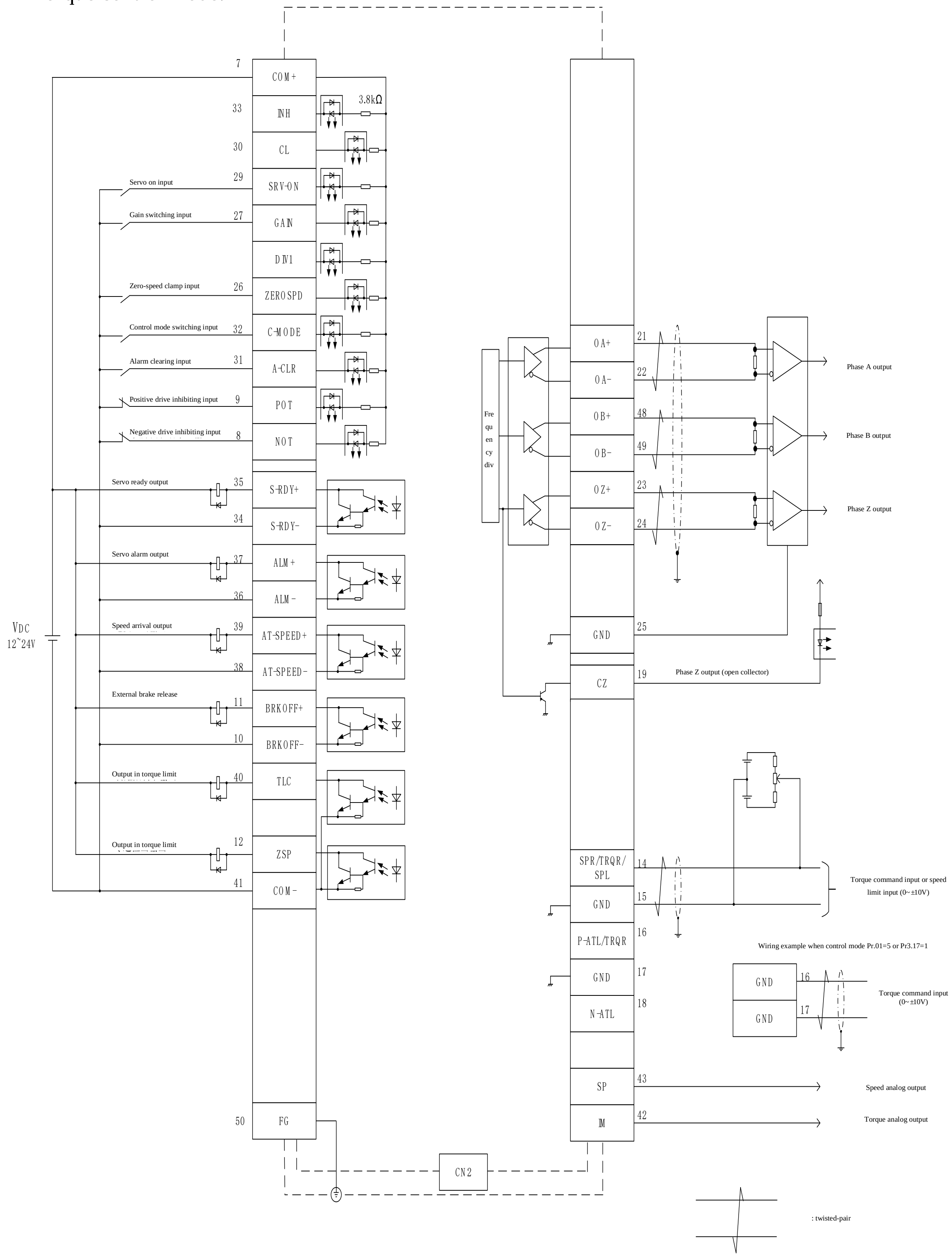


Figure 2.12.1-3 Torque control mode

Full-closed loop control mode:

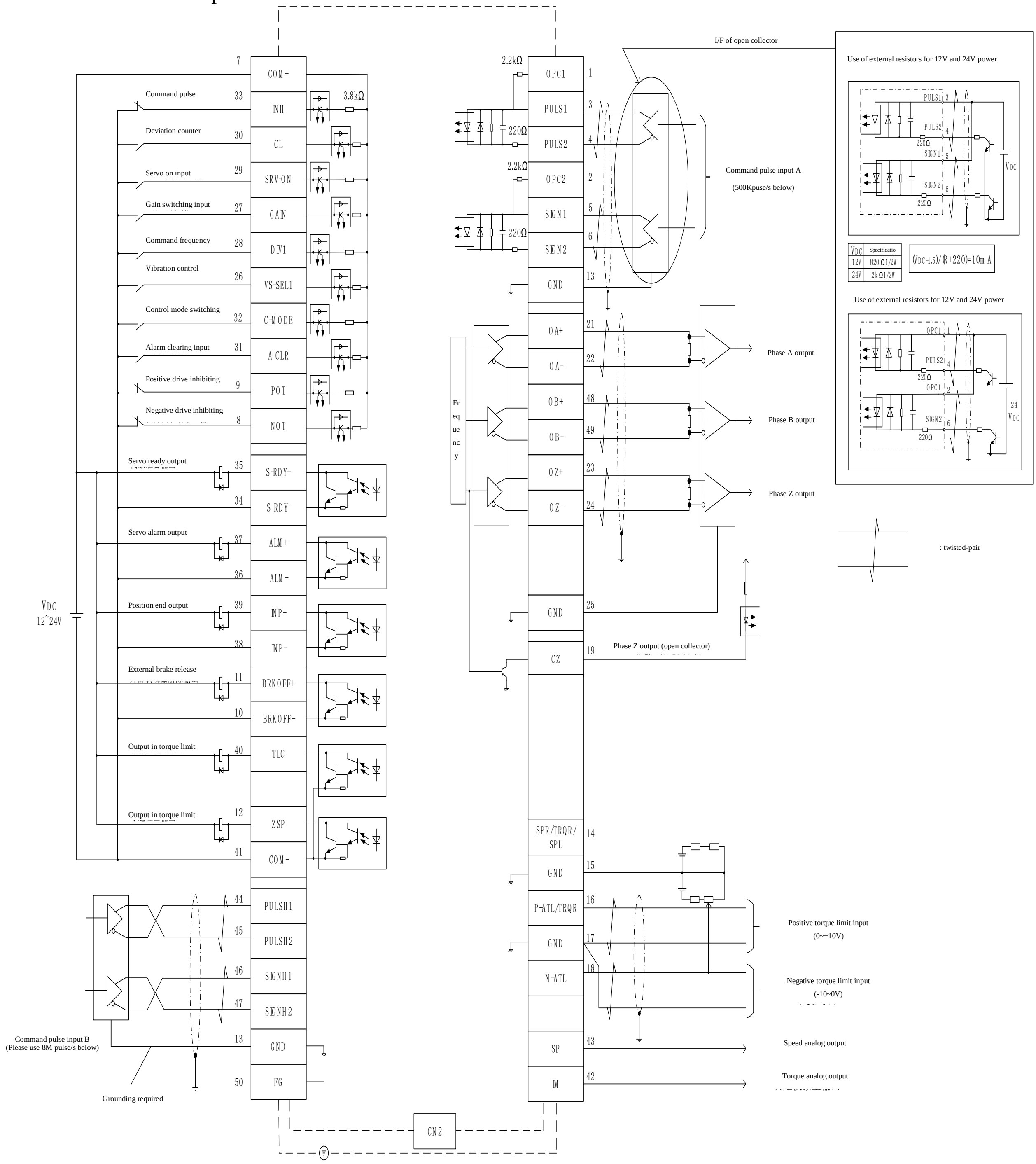
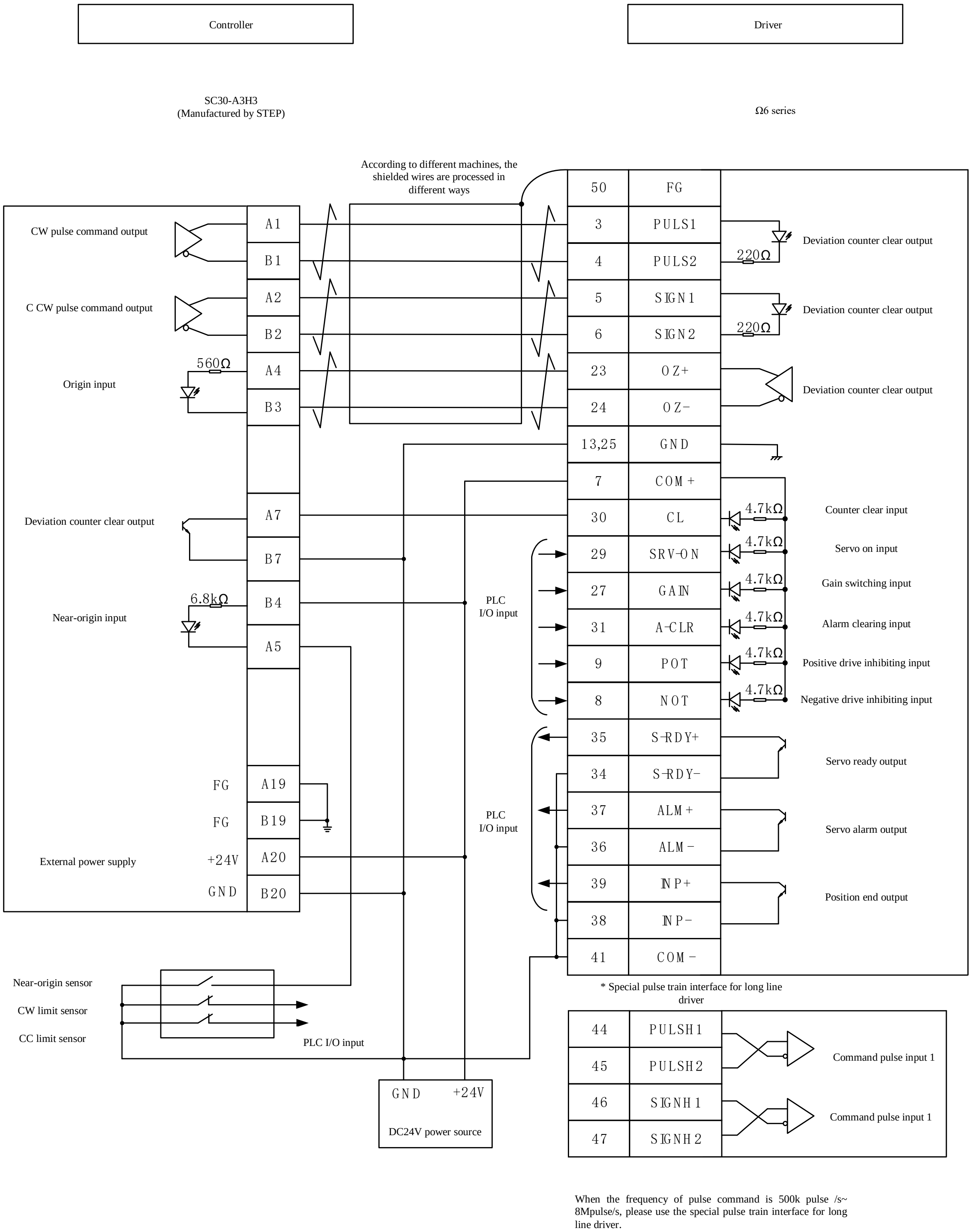


Figure 2.12.1-4 Full-closed loop control mode

2.12.2 Example of connection to the upper computer



Be sure to use twisted pair cable when connecting.
¼ The internal circuit of the upper controller may have the latest change information. Please confirm with the manufacturer of the upper controller.

Near-origin input

Figure 2.12.2-1 Example of connection to the upper computer

2.13 Explanation of input and output of connector CN2

2.13.1 Connection to control input circuit

The connection to the driver control input circuit is realized via a relay or open collector transistor circuit. When a relay is used for connection, please select a relay for micro current. If the relay for micro current is not used, it will cause a poor contact. When using the transistor circuit of open collector for connection, in order to ensure sufficient current on the primary side of optocoupler, it is required to keep the lower limit voltage of power supply (12~24V) above 11.4V.

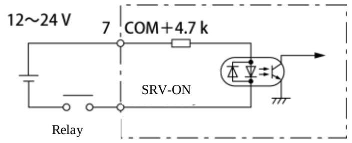
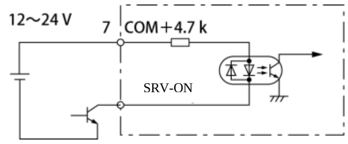
Relay interface circuit	Open collector interface circuit
	

Figure 2.13.1-1 Input circuit interface

2.13.2 Connection to control input signal (pulse input signal interface)

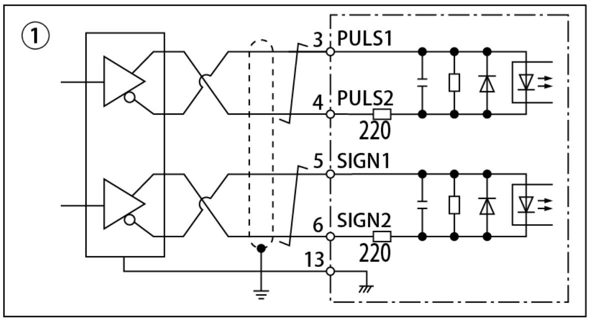
The following describes the terminals 21-22 (A-phase signal), 48-49 (B-phase signal) and 19-23 (C-phase signal) of CN2 connector:

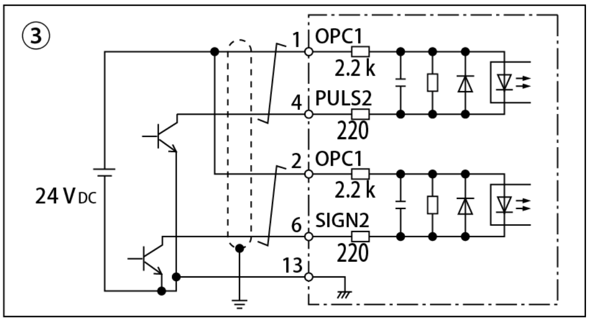
1. Long-line driver I/F (maximum allowable input frequency of command pulse input signal: 500kpulse/s) is a signal transmission mode which is not easily affected by noise. In order to improve the accuracy of signal transmission, this method is recommended.

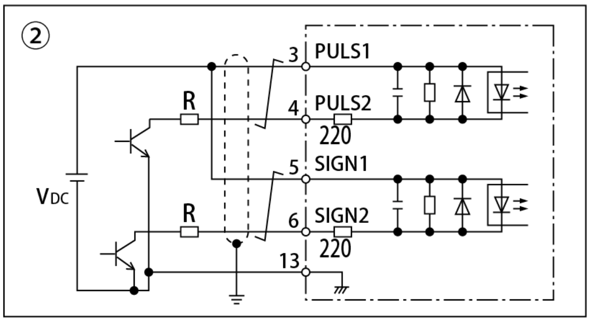
2. Open collector I/F (maximum allowable input frequency of command pulse input signal: 200kpulse/s) is a way of using the power supply (V_{DC}) for the control signal outside the driver. In this case, the V_{DC} corresponding current limiting resistor R is required, and the resistor R is selected as recommended in the following table. When the resistor is arranged near the driver, the anti-noise performance can be enhanced.

V_{DC}	Specification of resistor R
12V	82Ω, 1/2W
24V	2KΩ, 1/2W
$\frac{V_{DC}-1.5}{R+220}=10mA$	

3. Open collector I/F (maximum allowable input frequency of command pulse input signal: 200kpulse/s) Connection when current limiting resistor is not used in 24V power supply.







※The wiring length should be controlled to be (within 1m).

Maximum input voltage DC24V, rated current 10mA

twisted-pair

It is recommended to set Pr0.05=2 when using open collector.

Figure 2.13.2-1 Pulse train interface

2.13.3 Input signal and pin number

2.13.3.1 Input signal (common port) and its function

PINNo.	Signs	Signal name	Correlation model	P	S	T
7	COM＋	Power supply for control signal (+)	I/F circuit	--		
・Connect the 24V+pole of external DC power supply. ・Use a power supply voltage of 24V±5%						
41	COM－	Power supply for control signal (-)	I/F circuit	--		
・Connect the 24V -pole of external DC power supply. ・The power supply capacity varies according to the structure of the transceiver circuit used. More than 0.5A is recommended. ・There is no connection with GND inside.						

2.13.3.2 Input signal (pulse) and its function

PIN, No.	Signs	Signal name	Correlation model	P	S	T
44	PULSH1	Command pulse input 1	I/F circuit	Section 2.13.3		
45	PULSH2					
46	SIGNH1	Command symbol input 1				
47	SIGNH2					
・This is the input terminal of position command pulse. Pr0.05 (command pulse input selection) can be set to 1 for selection. ・Speed control, torque control, and other control modes without position command is invalid. ・The maximum allowable input frequency is 8Mpulse/s. There are six command pulse input modes for selection from Pr0.06 (command pulse rotation direction setting) and Pr0.07 (command pulse input mode setting).						

PIN, No.	Signs	Signal name	Correlation model	P	S	T

1	OPC1	Command pulse input 1	I/F circuit	Section 2.13.2
3	PULS1			
4	PULS2			
2	OPC1	Command symbol input 2		
5	SIGN1			
6	SIGN2			

・This is the input terminal of position command pulse. Pr0.05 (command pulse input selection) can be set to 0 for selection.

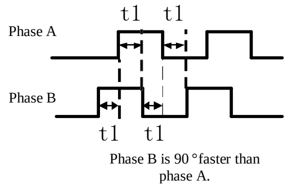
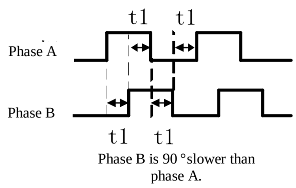
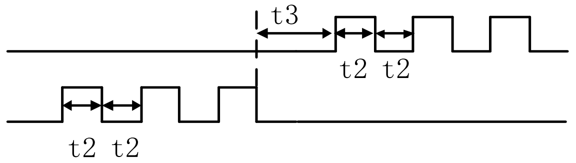
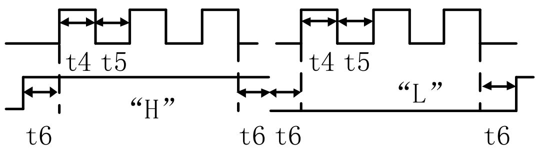
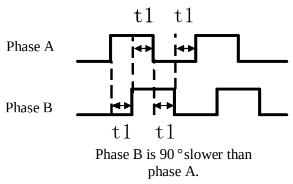
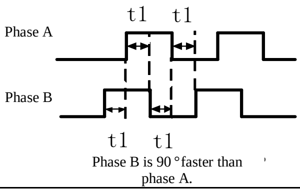
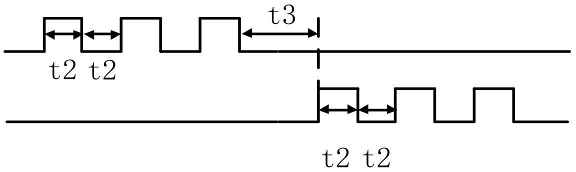
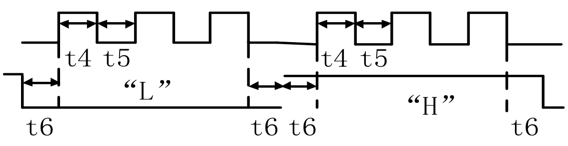
・ It is recommended to set Pr0.05 = 2 when using an open collector I/F.

・Speed control, torque control, and other control modes without position command is invalid.

The maximum allowable input frequency is 500kpulse/s for differential input and 200kpulse/s for open collector input.

There are six command pulse input modes for selection from Pr0.06 (command pulse rotation direction setting) and Pr0.07 (command pulse input mode setting). For details, please refer to “Command pulse input form” on the next page.

Command pulse input form

Pr0.06 (Command pulse rotation direction setting)	Pr0.07 (Set value of command pulse input mode)	Command pulse form	Signal name	Positive direction command	Negative direction command
0	0 or 2	90 °phase difference Two-phase pulse (Phase A + Phase B)	PULS SIGN		
	1	Positive pulse train + Negative pulse train	PULS SIGN		
	3	Pulse train + symbol	PULS SIGN		
1	0 or 2	90 °phase difference Two-phase pulse (Phase A + Phase B)	PULS SIGN		
	1	Positive pulse train + Negative pulse train	PULS SIGN		
	3	Pulse train + symbol	PULS SIGN		

PULS and SIGN are the output of pulse train input circuit.
In case of forward pulse train+reverse pulse train and pulse train+symbol, read the pulse train at the rising edge.
In the case of two-phase pulse, the pulse train is read at each edge.

Maximum allowable input frequency and minimum necessary time width of command pulse input signal)

PULS/SIGN signal input I/F		Maximum allowable input frequency	Minimum necessary time width (μs)					
			t1	t2	t3	t4	t5	t6
PULSH1, 2 SIGNH1, 2	In case of phase AB input, after 4-time frequency	8Mpps	0.0625	0.125	0.25	0.125	0.125	0.125
	Beyound the AB phase input	8Mpps	0.0625	0.0625	0.125	0.0625	0.0625	0.0625
PULS1, 2 SIGN1, 2	Long line drive interface	500kpps	0.5	0.5	1	0.5	0.5	0.5
	Open collector interface	200kpps	1.25	1.25	2.5	1.25	1.25	1.25

2.13.3.3 Control input

The control input signal can be the input PIN o I/F connector for arbitrary distribution of each function. The factory distribution state is as follows:

PIN No.	Signal Name	Signs	Corresponding Parameter	Default	Position control		Speed control		Torque control	
					Signal Name	Logics	Signal Name	Logics	Signal Name	Logics
8	SI1 Input	SI1	Pr4.00	00828282h(8553090)	NOT	Normally closed (NC)	NOT	Normally closed (NC)	NOT	Normally closed (NC)
9	SI2 Input	SI2	Pr4.01	00818181h(8487297)	POT	Normally closed (NC)	POT	Normally closed (NC)	POT	Normally closed (NC)
26	SI3 Input	SI3	Pr4.02	0091910Ah(9539850)	VS-SEL1	Normally closed (NO)	ZERO SPD	Normally closed (NC)	ZERO SPD	Normally closed (NC)
27	SI4 Input	SI4	Pr4.03	00060606h(394758)	GAIN	Normally closed (NO)	GAIN	Normally closed (NO)	GAIN	Normally closed (NO)
28	SI5 Input	SI5	Pr4.04	0000100Ch(4108)	DIV1	Normally closed (NO)	INTSPD3	Normally closed (NO)	---	---
29	SI6 Input	SI6	Pr4.05	00030303h(197379)	SRV-ON	Normally closed (NO)	SRV-ON	Normally closed (NO)	SRV-ON	Normally closed (NO)
30	SI7 Input	SI7	Pr4.06	00000f07h(3847)	CL	Normally closed (NO)	INTSPD2	Normally closed (NO)	---	---
31	SI8 input	SI8	Pr4.07	00040404h(263172)	A-CLR	Normally closed (NO)	A-CLR	Normally closed (NO)	A-CLR	Normally closed (NO)
32	SI9 input	SI9	Pr4.08	00050505h(328965)	C-MODE	Normally closed (NO)	C-MODE	Normally closed (NO)	C-MODE	Normally closed (NO)
33	SI1	SI10	Pr4.09	00000E88h(	INH	Normal	INTS	Normall	---	---

	input			3720)		ly closed (NC)	PD1	y closed (NO)		

2.13.3.4 Functions that can be distributed to control input

Signal name	Servo enable on input			Correlation model	P	S	T
Signs	SRV-ON	Initial setting of distribution	29 (SI6)	I/F circuit	Section 2.13.1		
Servo enable (motor power on/off) control signal.							

Signal name	Positive drive inhibiting input			Correlation model	P	S	T
Signs	POT	Initial setting of distribution	9 (SI2)	I/F circuit	Section 2.13.1		
This is the positive drive prohibited input. When the input is ON, the action is set through Pr5.04”Drive inhibitinput setting” In use, set Pr5.04”Drive inhibitinput setting”outside 1, when the running mechanism exceeds the movable range in positive direction, please open this function, with input signal ON.							

Signal name	Negative drive inhibiting input			Correlation model	P	S	T
Signs	NOT	Initial setting of distribution	8 (SI1)	I/F circuit	Section 2.13.1		
This is the negative drive prohibited input. When the input is ON, the action is set through Pr5.04 [Drive inhibitinput setting]. In use, set Pr5.04”Drive inhibitinput setting”outside 1, when the running mechanism exceeds the movable range in negative direction, please open this function, with input signal ON.							

Signal name	Deviation counter resetting input			Correlation model	P	S	T
Signs	CL	Initial setting of distribution	30 (SI7)	I/F circuit	Section 2.13.1		
Reset the position deviation counter. Default setup is edge triggering resetting. When making a change, please set through Pr5.17 “Counter clearing input mode”. Deviation counter resetting input OFF indicates that the input photoelectric coupler is not connected, and ON indicates that the input photoelectric coupler is connected.							

Signal name	Alarm clearing input			Correlation model	P	S	T
Signs	A-CLR	Initial setting of distribution	31 (SI8)	I/F circuit	Section 2.13.1		
Release alarm/warming state. There is an alarm that cannot be cleared through this input. If the alarm clearing input (A-CLR) is effective, various alarms/warnings can be cleared.							

Signal name	Command pulse prohibited input			Correlation model	P	S	T
Signs	INH	Initial setting of distribution	31 (SI8)	I/F circuit	Section 2.13.1		
Ignore position pulse command. In use, please set Pr5.18 “command pulse prohibited input invalid] to 0.							

Signal name	Control mode switching input			Correlation model	P	S	T
Signs	C-MODE	Initial setting of distribution	32 (SI9)	I/F circuit	Section 2.13.1		
Control mode switching All control modes require this signal. Pleas set position/full closed-loop control, speed control, torque control as the same logic. If not, there will be an error. Please do not enter the command 10ms before and after switching control mode.							

Signal name	Command frequency division and multiplication			Correlation	P	S	T

	switching input 1			model			
Signs	DIV1	Initial setting of distribution	28 (SI5)	I/F circuit	Section 2.13.1		
Signal name	Command frequency division and multiplication switching input 2						
Signs	DIV2	Initial setting of distribution	---				

Maximum 4 switchings of DIV1 and DIV2 are used as the numerator of command frequency division

Numerator/dominator comparison table of command frequency division processing selected for DIV1, DIV2

DIV1	DIV2	Command frequency division processing	
		Numerator	Denominator
OFF	OFF	Pr0.09	Pr0.10
ON	OFF	Pr5.00	Pr0.10
OFF	ON	Pr5.01	Pr0.10
ON	ON	Pr5.02	Pr0.10

Signal name	Gain switching input			Correlation model	P	S	T
Signs	GAIN	Initial setting of distribution	27 (SI4)	I/F circuit	Section 2.13.1		

Switch the 1st/2nd gain.

Signal name	Torque limit switching input			Correlation model	P	S	T
Signs	TL-SEL	Initial setting of distribution	27 (SI4)	I/F circuit	Section 2.13.1		

Switch the 1st/2nd torque limit.

Pr5.21	Torque limit switching input (TL-SEL)	Torque limit switching setting (Pr5.21, Pr5.24)	Positive torque limit	Negative torque limit
0			Analog input	
1	——	——	Pr0.13	
2	——	——	Pr0.13	Pr5.22
3	OFF	Valid	Pr0.13	
	ON		Pr5.22	
4			Analog input	
5				
6	OFF	——	Pr0.13	Pr5.22
	ON		Pr5.25	Pr5.26

Signal name	Internal command speed selection 1 input			Correlation model	P	S	T
Signs	INTSPD1	Initial setting of distribution	33 (SI10)	I/F circuit	Section 2.13.1		

Signal name	Internal command speed selection 2 input			Correlation model	P	S	T
Signs	INTSPD2	Initial setting of distribution	30 (SI7)	I/F circuit	Section 2.13.1		

Signal name	Internal command speed selection 3 input			Correlation model	P	S	T
Signs	INTSPD3	Initial setting of distribution	33 (SI5)	I/F circuit	Section 2.13.1		

Select the internal command speeds 1～8. Relationship of Pr3.00"Internal and external switching of speed setting" and internal command speed selection 1-3 with selected speed command				
Pr3.00	Internal command speed selection 1 (INTSPD1)	Internal command speed selection 2 (INTSPD2)	Internal command speed selection 3 (INTSPD3)	Speed command selection
1	OFF	OFF	No effect	Speed 1
	ON	OFF		Speed 2
	OFF	ON		Speed 3
	ON	ON		Speed 4
2	OFF	OFF	No effect	Speed 1
	ON	OFF		Speed 2
	OFF	ON		Speed 3
	ON	ON		Analog speed command
3	Like Pr3.00=1		OFF	Speed 1 -4
	OFF	OFF	ON	Speed 5
	ON	OFF	ON	Speed 6
	OFF	ON	ON	Speed 7
	ON	ON	ON	Speed 8

Signal name	Zero-speed clamp input			Correlation model	P	S	T
Signs	ZEROSPD	Initial setting of distribution	26 (SI13)	I/F circuit	Section 2.13.1		
Set the speed command to 0. Please set Pr3.15"Zero clamping function selection"≠0 before use.							

Signal name	Speed command symbol input			Correlation model	P	S	T
Signs	VC-SIGN	Initial setting of distribution	--	I/F circuit	Section 2.13.1		
A symbol that specifies the speed command input under speed control. Refer to Pr3.01"Speed command direction setting selection".							

Signal name	Torque command symbol input			Correlation model	P	S	T
Signs	TC-SIGN	Initial setting of distribution	--	I/F circuit	2.13.1		
A symbol that specifies the torque command input under torque control							

ON	Negative direction
OFF	Positive direction

Refer to Pr3.18"Torque command direction setting selection".

Signal name	Forced alarm input			Correlation model	P	S	T
Signs	E-STOP	Initial setting of distribution	--	I/F circuit	Section 2.13.1		
Make it generate Err87.0"Abnormal forced alarm input".							

2.13.3.5 Input signal (analog command)

PIN, No.	14	Signal name	AI1 input	Corresponding function
		Signs	AI1	SPR, TRQR
PIN, No.	16	Signal name	AI2 input	Corresponding function
		Signs	AI2	TRQ, P-ATL
PIN, No.	18	Signal name	AI3 input	Corresponding function
		Signs	AI3	N-ATL

2.13.3.6 Assignable function of input signal (analog command)

Signal name	Forward torque limit input	Correlation model	P	S	T
Signs	P-ATL	I/F circuit	Section 2.13.4		

Signal name	Negative torque limit input	Correlation model	P	S	T
Signs	N-ATL	I/F circuit	Section 2.13.4		

Specify torque limits in each direction at the analog voltage.

Pr5.21	Forward analog Torque limit input (P-ATL)	Negative analog Torque limit input (N-ATL)	Positive torque limit	Negative torque limit
0	0～ 10V	-10V～0V	P-ATL	N-ATL
5	0～ 10V	No effect	P-ATL	

*1. When specifying the torque limit, please refer to P.4-54.Pr5.21"Torque limit selection".

Signal name	Speed command input	Correlation model	P	S	T
Signs	SPR	I/F circuit	Section 2.13.4		

Specify torque limits in each direction at the analog voltage.

Pr5.21	Forward analog Torque limit input (P-ATL)	Negative analog Torque limit input (N-ATL)	Positive torque limit	Negative torque limit
0	0～ 10V	-10V～0V	P-ATL	N-ATL
5	0～ 10V	No effect	P-ATL	

Input the speed command at analog voltage.

The conversion diagram of the input voltage from the analog speed command to the speed command is shown below according to the combination of parameters Pr3.00"Internal and external switching of speed setting", Pr3.01"Speed command direction setting selection", Pr3.03"Speed command input reversal", analog speed command (SPR) and speed command symbol selection (VC-SIGN) of I/F connector, and the relationship with the motor rotation direction.

Pr3.00	Pr3.01	Pr3.03	Analog speed command (SPR)	Speed command symbol selection (VC-SIGN)	Motor Rotation direction
0 (2)*	0	0	Voltage (0～10V)	No effect	Positive direction
			Voltage (-10～0V)	No effect	Negative direction
		1	Voltage (0～10V)	No effect	Negative direction
			Voltage (-10～0V)	No effect	Positive direction
	1	No effect	Voltage (0～10V)	OFF	Positive direction
			Voltage (-10～0V)		
			Voltage (0～10V)	ON	Negative direction
			Voltage (-10～0V)		

* When the internal command speed selection 1 and internal command speed selection 2 are "ON".

Signal name	Torque command input	Correlation model	P	S	T
Signs	TRQR	I/F circuit	Section 2.13.4		

Input torque command at analog voltage.

When Pr3.17"Torque command selection" = 0: PIN.No.14

When Pr3.17"Torque command selection" = 1: PIN.No.16

Pr3.17	Pr3.18	Pr3.20	Analog speed command (TRQR)	Speed command symbol selection (VC-SIGN)	Motor Rotation direction
0	0	0	Voltage (0～10V)	No effect	Positive direction
			Voltage (-10～0V)	No effect	Negative direction

			1	Voltage (0～10V)	No effect	Negative direction	
				Voltage (-10～0V)	No effect	Positive direction	
		1	No effect	Voltage (0～10V)	OFF	Positive direction	
				Voltage (-10～0V)			
				Voltage (0～10V)	ON	Negative direction	
				Voltage (-10～0V)			

2.13.4 Output signal and pin number

2.13.4.1 Output signal (common) and its function

The control output signal can be assigned to any function of the I/F connector. The output PIN cannot change the logic. The default distribution state is as follows:

PIN No.	Signal name	Signs	Corresponding parameter	Default	Position control Signal name	Speed control Signal name	Torque control Signal name
10 11	SO1 output	PIN.No.10: SO1 - PIN.No.11: SO1 +	Pr4.10	00030303h (197379)	BRK-OFF	BRK-OFF	BRK-OFF
34 35	SO2 output	PIN.No.34: SO2 - PIN.No.35: SO2 +	Pr4.11	00020202h (131586)	S-RDY	S-RDY	S-RDY
36 37	SO3 output	PIN.No.36: SO3 - PIN.No.37: SO3 +	Pr4.12	00010101h (65793)	ALM	ALM	ALM
38 39	SI4 input	PIN.No.38: SO4 - PIN.No.39: SO4 +	Pr4.13	00050504h (328964)	INP	AT-SPEED	AT-SPEED
12	SO5 output	SO5	Pr4.14	00070707h (460551)	ZSP	ZSP	ZSP
40	SO6 output	SO6	Pr4.15	00060606h (394758)	TLC	TLC	TLC
Due to parameter setting, the function will change. For details, refer to 4.1 Parameter setting 4.1.5. Refer to "Functions assignable to control output".							

2.13.4.2 Functions assignable to control output

Signal name	Servo alarm output			Correlation model	P	S	T
Signs	ALM	Initial setting of distribution	36.37 (SO3)	I/F circuit			
Output signal when an alarm occurs. The output transistor is "ON" when it is normal, and "OFF" when an alarm occurs.							

Signal name	Servo ready output			Correlation model	P	S	T
Signs	S-RDY	Initial setting of distribution	34.35 (SO2)	I/F circuit			
Output signal when the driver is energized.							

Set control/main power supply. Output transistor is "ON" when not in alarm state.

Signal name	External brake release signal			Correlation model	P	S	T
Signs	BRK-OFF	Initial setting of distribution	10.11 (SO1)	I/F circuit			
Output the sequence signal to make the motor holding brake act. The output transistor is on when the holding brake is released.							

Signal name	Positioning end			Correlation model	P	S	T
Signs	INP	Initial setting of distribution	38.39 (SO4)	I/F circuit			

Signal name	Positioning end 2			Correlation model	P	S	T
Signs	INP2	Initial setting of distribution	—	I/F circuit			
Output positioning end signal/positioning end signal 2. The output transistor is switched on at the positioning end state.							

Signal name	Speed arrival output			Correlation model	P	S	T
Signs	AT-SPEED	Initial setting of distribution	38.39 (SO4)	I/F circuit			
Output speed arrival signal The output transistor is switched on in the speed arrival state.							

Signal name	Signal output in torque limit			Correlation model	P	S	T
Signs	TLC	Initial setting of distribution	40 (SO6)	I/F circuit			
Output the signal under torque limit. The output transistor is switched on in the torque limit state.							

Signal name	Zero speed detection signal			Correlation model	P	S	T
Signs	ZSP	Initial setting of distribution	12 (SO5)	I/F circuit			
Output zero speed detection signal. The output transistor is switched on in the zero speed detection state.							

Signal name	Speed consistency output			Correlation model	P	S	T
Signs	V-COIN	Initial setting of distribution	—	I/F circuit			
Output speed consistency signal. The output transistor is switched on in the speed consistency detection state.							

Signal name	Warning output 1			Correlation model	P	S	T
Signs	WARN1	Initial setting of distribution	—	I/F circuit			
Output the warning output signal set by Pr4.40"Warning output selection 1". The output transistor is switched on in the warning state.							

Signal name	Warning output 1			Correlation model	P	S	T
Signs	WARN2	Initial setting of distribution	—	I/F circuit			
Output the warning output signal set by Pr4.41"Warning output selection 2". The output transistor is switched on in the warning state.							

Signal	Position command output or not			Correlation	P	S	T

name				model			
Signs	P-CMD	Initial setting of distribution	—	I/F circuit			
The output transistor is switched on when the position command is available.							

Signal name	Output under speed limit			Correlation model	P	S	T
Signs	V-LIMIT	Initial setting of distribution	—	I/F circuit			
The output transistor is switched on in the speed limit state under torque control.							

Signal name	Alarm clear property output			Correlation model	P	S	T
Signs	ALM-ATB	Initial setting of distribution	—	I/F circuit			
The output transistor is switched on when an alarm that can be cleared occurs.							

Signal name	Speed command output or not			Correlation model	P	S	T
Signs	V-CMD	Initial setting of distribution	—	I/F circuit			
The output transistor is switched on when the speed command is available under speed control.							

Signal name	Servo enable state output			Correlation model	P	S	T
Signs	SRV-ST	Initial setting of distribution	—	I/F circuit			
The output transistor is switched on when the servo is enabled.							

2.13.4.3 Pulse output and its functions

PIN No.	21 22	Signal name	Phase A output	Correlation model	P	S	T
		Signs	PIN.No.21：OA＋ PIN.No.22：OA-	I/F circuit			

PIN No.	48 49	Signal name	Phase B output	Correlation model	P	S	T
		Signs	PIN.No.21：OB＋ PIN.No.22：OB-	I/F circuit			

PIN No.	23 24	Signal name	Phase Z output	Correlation model	P	S	T
		Signs	PIN.No.21：OZ＋ PIN.No.22：OZ-	I/F circuit			
Encoder signal after differential output frequency division processing The ground wire of the long line driver of the output circuit is connected to the signal ground (GND) and is not insulated. The maximum output frequency is 4 Mpulse/s (after 4 octave).							

PIN No.	19	Signal name	Phase Z output	Correlation model	P	S	T
		Signs	CZ	I/F circuit			
This is the open collector output of the Z-phase signal. The emitting electrode of the transistor in the output circuit is connected to the signal ground (GND) and is not insulated. Please be careful not to be affected by noise when using this CZ signal. Note that the open collector output (CZ) of phase Z has the opposite logic to the long line driver output (OZ).							

2.13.4.4 Analog monitor output and its functions

<table>
<tr><td rowspan="2">PIN No.</td><td rowspan="2">42</td><td>Signal name</td><td>Analog monitor output 2</td><td>Correlation model</td><td>P</td><td>S</td><td>T</td></tr>
<tr><td>Signs</td><td>IM</td><td>I/F circuit</td><td colspan="3"></td></tr>
<tr><td colspan="8">Change the definition of the output signal through Pr4.18 (Analog monitor 2).
Output analog monitor 2.</td></tr>
</table>

<table>
<tr><td rowspan="2">PIN No.</td><td rowspan="2">43</td><td>Signal name</td><td>Analog monitor output 2</td><td>Correlation model</td><td>P</td><td>S</td><td>T</td></tr>
<tr><td>Signs</td><td>SP</td><td>I/F circuit</td><td colspan="3"></td></tr>
<tr><td colspan="8">Change the definition of the output signal through Pr4.16 (Analog monitor 1).
Output analog monitor 1.</td></tr>
</table>

2.13.4.5 Output signals (other) and their functions

<table>
<tr><td rowspan="2">PIN No.</td><td rowspan="2">13, 15, 17, 25</td><td>Signal name</td><td>Signal ground</td><td>Correlation model</td><td>P</td><td>S</td><td>T</td></tr>
<tr><td>Signs</td><td>GND</td><td>I/F circuit</td><td colspan="3">—</td></tr>
<tr><td colspan="8">Signal ground.
Insulated with the control signal power supply (COM-) inside the driver.</td></tr>
</table>

<table>
<tr><td rowspan="2">PIN No.</td><td rowspan="2">50</td><td>Signal name</td><td>Enclosure ground</td><td>Correlation model</td><td>P</td><td>S</td><td>T</td></tr>
<tr><td>Signs</td><td>FG</td><td>I/F circuit</td><td colspan="3">—</td></tr>
<tr><td colspan="8">Connected to the ground terminal inside the servo driver.</td></tr>
</table>

2.14 I/F monitor settings

2.14.1 I/F control input setting method

Signal name	Signs	Function No.	
		Normally on (NO)	Normally closed (NC
Invalid	-	00h	Inhibiting setting
Positive drive input inhibiting	POT	01h	81h
Negative drive input inhibiting	NOT	02h	82h
Servo enable input	SRV-ON	03h	83h
Alarm clearing	A-CLR	04h	Inhibiting setting
Control mode switching input	C-MODE	05h	85h
Gain switching input	GAIN	06h	86h
Deviation counter resetting input	CL	07h	Inhibiting setting
Command pulse inhibiting input	INH	08h	88h
Torque limit switching input	TL-SEL	09h	89h
Command frequency division and multiplication switching input 1	DIV1	0Ch	8Ch
Command frequency division and multiplication switching input 2	DIV2	0Dh	8Dh
Internal command speed selection 1 input	INTSPD1	0Eh	8Eh
Internal command speed selection 2 input	INTSPD2	0Fh	8Fh
Internal command speed selection 3 input	INTSPD3	10h	90h
Zero-speed clamp input	ZEROSPD	11h	91h
Speed command symbol input	VC-SIGN	12h	92h
Torque command symbol input	TC-SIGN	13h	93h
Forced alarm input	E-STOP	14h	94h

Signal name	Connector CN2 PIN No.	Parameter No.
SI1 input selection	8	Pr4.00
SI2 input selection	9	Pr4.01
SI3 input selection	26	Pr4.02
SI4 input selection	27	Pr4.03
SI5 input selection	28	Pr4.04
SI6 input selection	29	Pr4.05

SI7 input selection	30	Pr4.06
SI8 input selection	31	Pr4.07
SI9 input selection	32	Pr4.08
SI10 input selection	33	Pr4.09

00－－－－★★h: position control

00－－◆◆－－h: speed control

00※※－－－－h: torque control

For "※※","◆◆" and"★★" part,
please set the function and model according to the above table.
Example: 1. Parameter setting

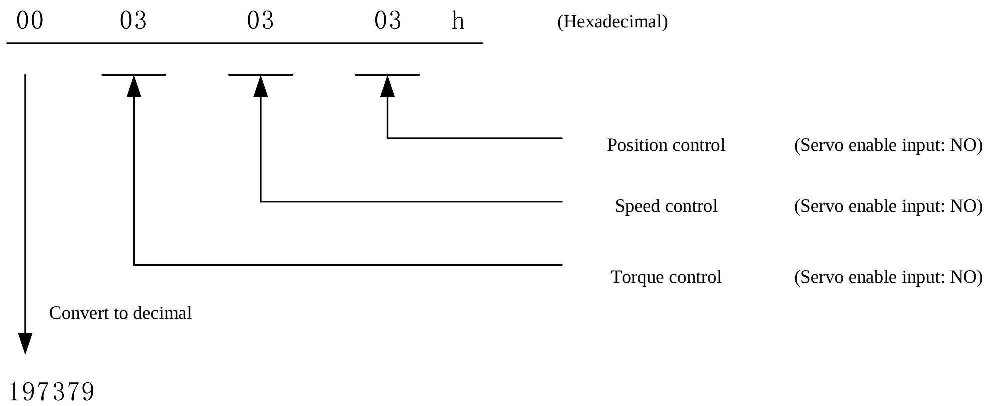


Fig. 2.14.1-1 Parameter setting

Example: 2. Parameter setting

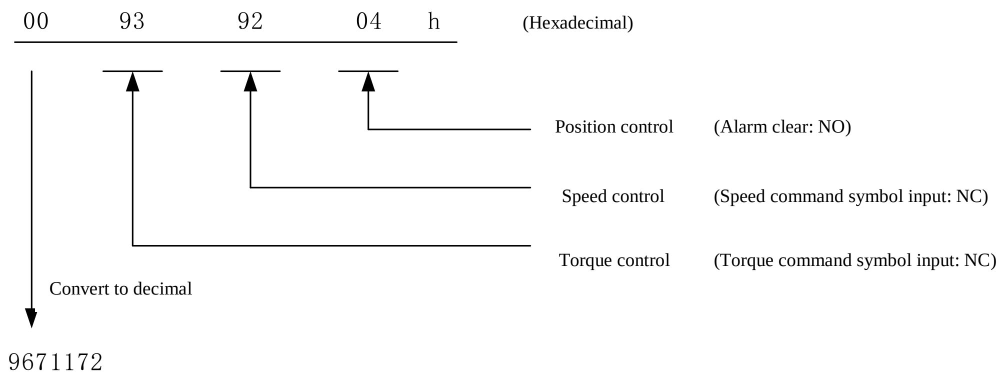


Fig. 2.14.1-2 Parameter setting

The following content records the parameter setting method. The parameters can be changed through LED panel and installation and debugging software[Ω Master].

00※※◆◆

The front panel displays decimal (6 digits).
The function is set in hexadecimal system, and the parameter is input in decimal system.
★★ h is hexadecimal.Fig. 2.14.1-3 system setting

SI1 input (connector CN2 Pin No. 8) indicates that negative drive input inhibiting is normally closed in the factory default.
When using position control or full-closed loop control, set the 7th digit from left to right to 8 and the 8th digit to 2. Set negative drive input inhibiting to normally closed. From the first digit to the sixth digit on the left, no setting is required.
If 00000082h represents 82h, input 130 (decimal) in the parameter Pr4.00.

When setting multiple control modes, enter the function number from left to right to the 1st digit to the 8th digit, convert from hexadecimal to decimal, and enter the parameters, as shown in Example 1 (left).
Similarly, SI3 input (connector CN2 PIN No.26) has the factory default in the use of position control and has the function of grain switching input 1.
In addition, set the zero clamping input function when using speed control. When setting vibration control switching input under position control, input 10(decimal) in the parameter Pr4.02 at 0Ah, i.e. Ah. Under the speed control, convert 26PIN from zero clamping NC to NO, convert 00001100h to decimal and input 4352 in the parameter Pr4.02.

Note:

1. Do not set anything other than the function number in the table.
2. The same function cannot be assigned to multiple signals. If so, Err33.0"I/F repeated input assignment exception 1" and Err33.1"I/F repeated input assignment exception 2" will occur.
3. Servo enable on signal (SRV-ON) must be assigned. If not, servo cannot be enabled.
4. When switching the input in the control mode (C-MODE), it is necessary to set in all control modes. If only one or two control modes are set, Err33.2"I/F input function number exception 1" or Err33.3"I/F input function number exception 2" will occur.
5. Control input PIN with invalid settings do not affect the action.
6. Note that when using functions under multiple control modes (input, alarm clear function and others are opened through servo enable), they must be assigned on the same PIN and be logical. If not set correctly, one of the errors like Err33.0"I/F repeated input assignment exception 1", Err33.1"I/F repeated input assignment exception 2", Err33.2"I/F input function number exception 1" and Err33.3"I/F input function number exception 2" will occur.
7. The deviation counter clear input (CL) can only be assigned to SI7 input. For any other assignment, Err33.6"Counter clear assignment exception" will occur.
8. The command pulse inhibiting input (INH) can only be assigned to SI10 input. For any other assignment, Err33.7"Command pulse inhibiting input" will occur.
9. Note that the front panel displays decimal.

2.14.2 I/F control output setting method

Function No.	Signal name	Signs
00h	Invalid	-
01h	Servo alarm output	ALM
02h	Servo ready output	S-RDY
03h	External brake release signal	BRK-OFF
04h	Positioning end	INP
05h	Speed arrival output	AT-SPEED
06h	Torque limit signal output	TLC
07h	Zero speed detection signal	ZSP
08h	Speed consistency output	V-COIN
09h	Warning output 1	WARN1
0Ah	Warning output 2	WARN2
0Bh	Position command output or not	P-CMD
0Ch	Positioning output 2	INP2
0Dh	Output under speed limit	V-LIMIT
0Eh	Alarm property output	ALM-ATB
0Fh	Speed command output or not	V-CMD

Signal name	Connector CN2 PIN No.	Parameter No.
SO1 output	10.11	Pr4.10
SO2 output	34.35	Pr4.11
SO3 output	36.37	Pr4.12
SO4 output	38.39	Pr4.13
SO5 output	12	Pr4.14
SO6 output	40	Pr4.15

00 - - - - ★★h: position control

00 - - ◆◆ - - h: speed control

00※※ - - - - h: torque control

For "※※","◆◆" and"★★" part,
Set the function number according to the above table.
Example: 1. Parameter setting

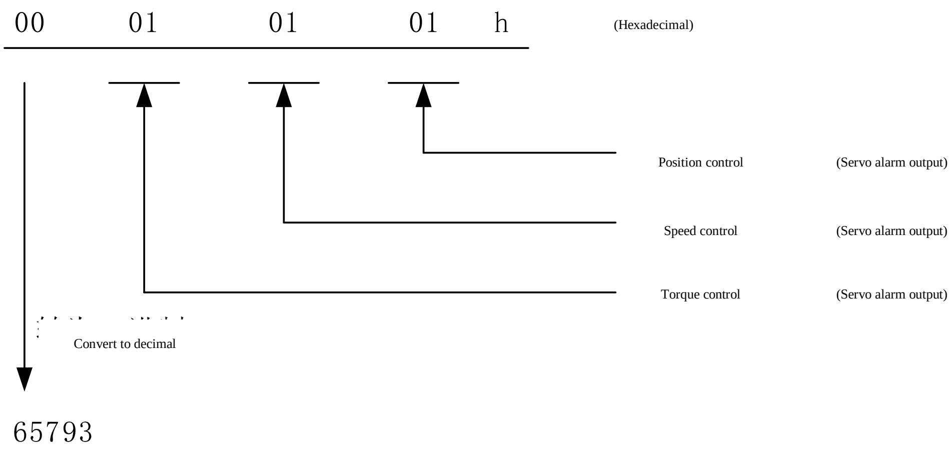


Fig. 2.14.2-1 Parameter setting

Example: 2. Parameter setting

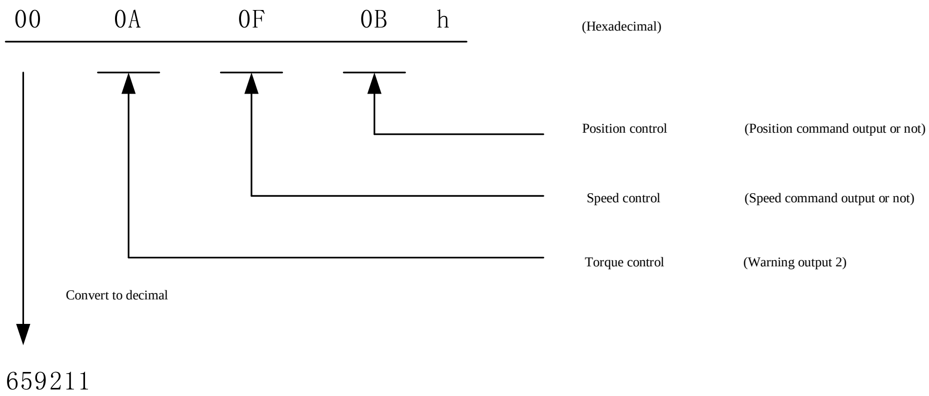


Fig. 2.14.2-2 Parameter setting

The parameters of the output signal can also be set by the same method described above.
The output signal can be assigned over multiple signals of the same function.
The invalid control output PIN is normally on and the output transistor is not connected. .
Do not set anything other than the function number in the table.

TIPS Note: * The front panel displays decimal.

3. Trial run

3.1 Inspections before trial run

1. Wiring inspection
(1) Whether there are errors (especially power input, motor output)
(2) Confirm whether it is reliably grounded
(3) Whether the connection is loose
2. Confirm whether the supply voltage is the rated voltage
3 Check whether the motor is fixed stably
4. Disconnect the motor shaft from the mechanical system
5. Brake release
6. At the end of the trial run, press the S key to turn off the servo

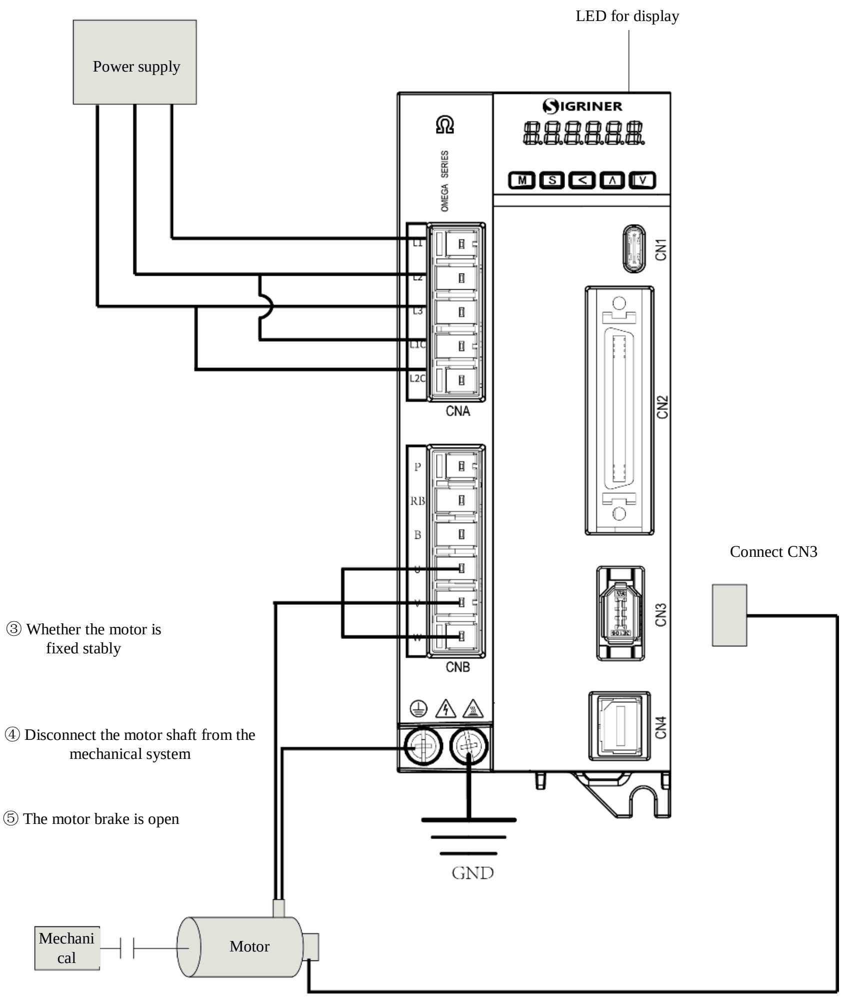


Fig. 3.1- 1 Inspections before trial run

3.2 Trial run of the connection of connector CN2

3.2.1 Trial run in position control mode

1. Connect connector CN2.
2.Enter the power (DC24V) in the control signal (COM＋, COM).
3. Turn on the power supply (driver).
4..Confirm the default values of parameters
5. Match to the output format of the host controller with Pr0.07（command pulse input mode setup）
6. Write to EEPROM and turn off/on the power(of the driver)
7.Connect the Servo-ON input（SRV-ON） and COM-(Connector X4， Pin-41) to bring the driver to Servo-ON status and energize the motor
8. Enter low frequency from t the host controller f to run the motor at low speed
9. Confirm the motor speedat monitor mode
(1) Whether the speed is the same as the setting or not
(2) Whether the motor stops by stopping the command (pulse) or not
10. if the motor does not run correctly , refer to "Display of Factor for No-Motor Running" or Preparation
The wiring diagram is show as follows:

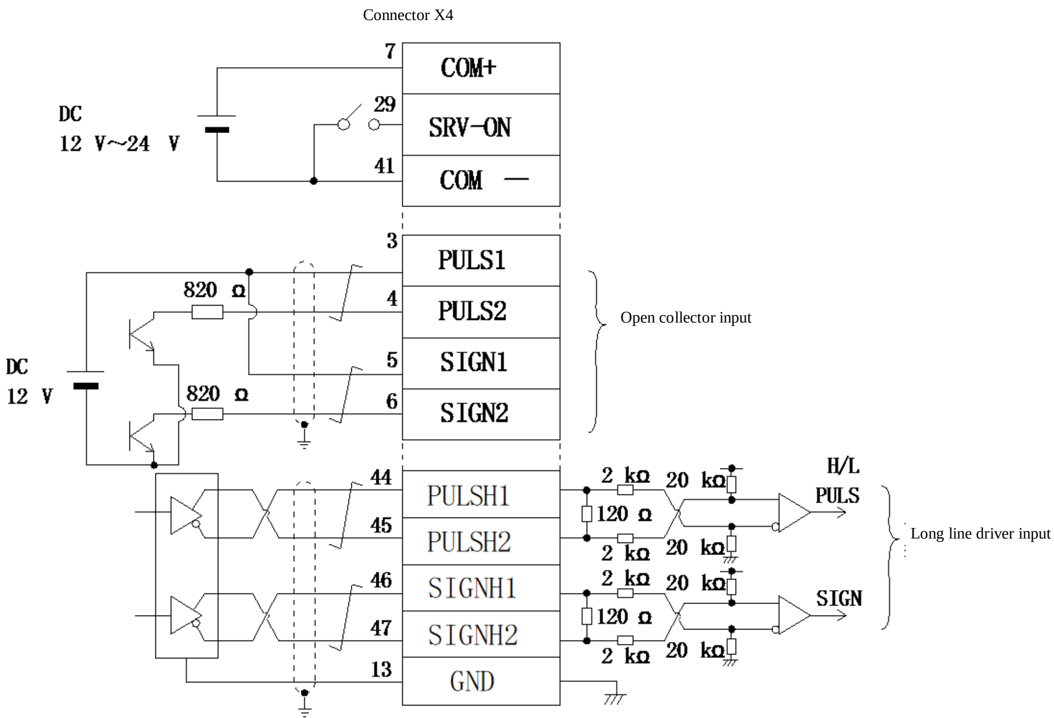


Fig. 3.2.1-1 Wiring diagram

Correlation parameters:

Parameter index	Parameter name	Set value
Pr0.01	Control mode setup	0
Pr5.04	Driver inhibiting input setup	1
Pr0.05	Selection of command pulse input	arbitrary value
Pr0.07	Command pulse input mode setup	1
Pr5.18	Invalidation of command pulse inhibit input	1
Pr5.17	Counter reset input setting	2

3.2.2 Trial run in speed control mode

1. Connect connector CN2.

2. Enter the power (DC12～ DC24V) to the control signal (COM＋, COM).
3. Enter the power supply (driver).
4. Confirm the default values of parameters.
5. Connect the Servo-On input(SRV-ON,Connector CN2 29 PIN) and COM-(Connector CN2 41PIN) to turn to Servo-ON and energize the motor
6. Disable the zero speed clamping input ZEROSPD, gradually increase the DC voltage between the speed command input SPR (connector CN214PIN) and GND (connector CN215PIN) from 0V and confirm the motor rotation state.
7. Confirm the motor rotation speed in monitor mode.
(1) Whether the rotation speed is the same as the setting value or not
(2) Whether the motor stops when the command is 0 or not
8. If the motor does rotate at a micro speed with command voltage of 0
9. Set the following parameters again when changing the rotational speed and direction.
Pr3.00: Internal and external switching of speed setting
Pr3.01: Speed command direction setting selection
Pr3.03: Reversal of speed command input
10. if the motor does not rotate correctly, Refer to "Display of the reason for No-motor Runningr" of Preparation
The wiring diagram is shown as follows:

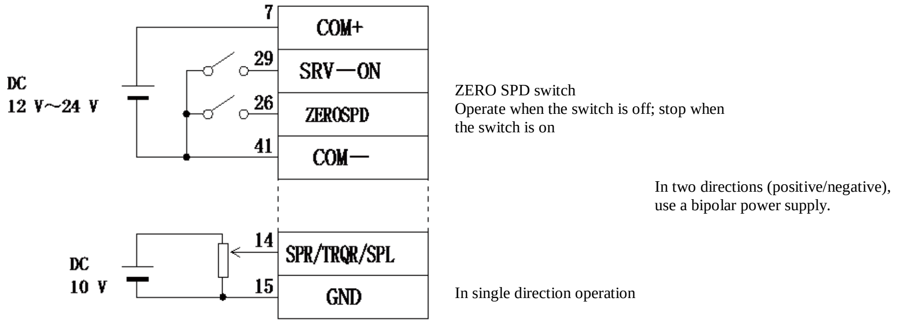


Fig. 3.2.2-1 Trial run in speed control mode

Correlation parameters:

Parameter index	Parameter name	Set value
Pr0.01	Control mode setup	1
Pr5.04	Driver inhibiting input setup	1
Pr3.15	Speed zero-clamp function selection	1
Pr3.00	Speed setup,Internal/External switching	Set up when necessary
Pr3.01	Speed command rotational direction selection	
Pr3.02	Input gain of speed command	
Pr3.03	Reversal of speed command input	
Pr4.22	Analog input 1(AI1) offset setup	
Pr4.23	Analog input 1(AI1) filter setup	

3.2.3 Trial run in torque control mode

1. Connect connector CN2.
2. Enter the power(DC12 to 24V) to control signal(COM+,COM-)
3. Enter the power to the driver
4. Confirm the default values of parameters
5. Set a lower value to Pr3.07(4th speed of speed setup)
6 Connect the Servo-On input(SRV-ON,Connector CN2 29 PIN) and COM-(Connector CN2 41PIN) to turn to Servo-ON and energize the motor
7. Confirm that the motor runs as per the setup of Pr3.07 by applying DC voltage(positive/negative) between the torque command input(Connector CN2 14 PIN) and GND(Connector CN2 15 PIN)
8. Set the following parameters when changing the torque magnitude direction and velocity limit value
(1) Pr3.19: Input gain of torque command
(2) Pr3.20: Input reversal of torque command
(3) Pr3.21: Speed limit value 1

9. If the motor does not rotate correctly, Refer to "Display of the reason for No-motor Runningr" of Preparation

The wiring diagram is show as follows:

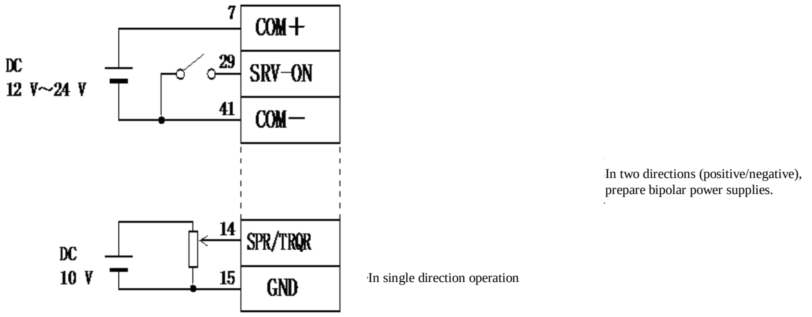


Fig. 3.2.3-1 Wiring diagram

Correlation parameters:

Parameter index	Parameter name	Set value
Pr0.01	Control mode setup	2
Pr5.04	Driver inhibiting input setup	1
Pr3.15	Speed zero-clamp function selection	0
Pr3.17	Torque command selection	0
Pr3.19	Input gain fo torque command	Set up when necessary
Pr3.20	Input reversal of torque command	
Pr3.21	Speed limit value 1	Lower value

3.3 Motor rotation speed and input pulse frequency setting

Input pulse frequency (pps)	Motor rotational speed (r/min)	Pr0.08 23bit
2M	3000	$2^{23}/40000$
500K	3000	$2^{23}/10000$
250%	3000	$2^{23}/5000$
100%	3000	$2^{23}/2000$
500%	1500	$2^{23}/20000$

Note: When setting Pr0.08 , the encoder resolution is automatically set up As numerators .For full closed controlling, setting Pr0.08 is ignored and setting of Pr0.09 and Pr0.10 are always applied

Please note that the maximum input pulse frequency will vary depending on the input terminal. The desireed setting can be determined by seletion value if numerator and denominator of electronic, but the operation will not be guaranteed when the setting of frequency division ratio or frequency multiplication ratio is extreme. The ratio should be in a range between 1/1000 and 8000. Excessively high multiplication ratio will cause Err27.2(command pulse multiplication error protection) due to varying command pulse input or noises ,even if the other settings are within the specified range When setting the comand division and multiplication ratio as numerator/ednominator, express it as Pr0.09/Pr0.10 with Pr0.08 = 0. For full closed controlling, setting of Pr0.08 is ignored and settings of Pr0.09 and Pr0.10 always applied.

Chapter 4 Parameter Settings

4.1 Parameter and object dictionary classification description

The parameters have the following properties:

1. No.
2. Accessible properties
3. Unit
4. Setting enabled
5. Correlation model
6. Data range
7. Factory default

"Accessible properties": see the table below for details.

Description of accessible properties	
Accessible properties	Description
RW	Readable/writable
WO	Write-only
RO	Read-only
CONST	Constant, read-only

For "related modes", please see the table below for details.

Description of related modes of parameters	
Correlation model	Description
P	Parameters are related to position control mode
S	Parameters are related to speed control mode
T	Parameters are related to torque control mode
ALL	Parameters are related to all control modes
F	Parameters are related to full-closed loop control mode

For "settings effective", please see the table below for details.

Requirements for effectiveness	Description
Immediately enabled	After the parameter is edited, the set value takes effect immediately
Re-electrifying	After the parameter is edited, the driver is switched on again and the set value takes effect

4.2 Parameter and mode setting

4.2.1 Outline/Setup/Connection

1. Outline of Parameter
The driver has various parameters to set its characteristics, functions, etc. This chapter will explain the function and purpose of each parameter. Read and comprehend very well so that you can adjust this driver in optimum condition for your running requirements
2. Setup of Parameter
● You can refer and set up the parameter with either one of the following
(1) Front panel of the driver
(2) combination of the setup supprot software "ΩMaster" and PC
For the setting on the computer, connect the computer with the driver connector CN1 using TYPE-C special connection cable. Make simple operation according to the following steps after installing the debugging software "ΩMaster".Setup with the PC
3. Use "ΩMaster" to:
(1) Setup and storage of the driver parameters and Writing to the memory (EEPROM).
(2) Monitoring of I/O,pulse input and load factor
(3) Display of the present alarm and reference of the error history
(4) Data measurement of wave-form graphic and bring of the stored data
(5) Normal auto-gain tuning
(6) Frequency characteristic measurement of the machine system.
■ How to Connect

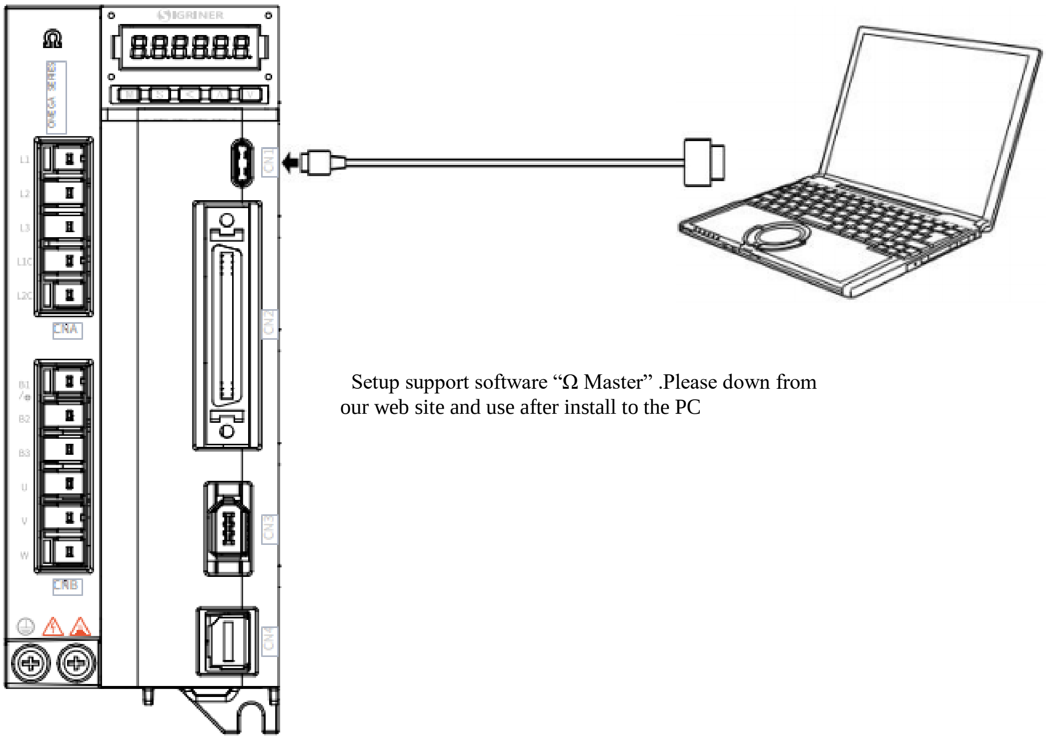


Fig. 4.2.1-1 Connection mode

4. USB cable
Use commercially available the TYPE-C Connectoron the driver
For the connector on the computer side, use the specification that matches the computer.
When using a cable without anti-noise magnetic ring, install anti-interference filters for signal lines at both ends of the cable.

4.2.2 Composition and list of parameters

Parameter No. is marked with PrX.YY(X: class, YY: No.).

Parameter No.		Class name	Type
classification	No.*		
0	00-17	Basic setting	Basic setting related parameters
1	00-27	Gain adjustment	Gain adjustment related parameters
2	00-30	Vibration control function	Vibration control related parameters
3	00-29	Speed and torque control · Choose an encoder in the state	Speed, torque control and full-closed loop related parameters
4	00-57	I/F monitor setting	Interface related parameters
5	00-86	Extension setting	Extension setting related parameters
6	00-76	Special setting	Special setting related parameters

Note: Enter 2 digits in "No." item.

● In this book, the following symbols are used to indicate each mode.

Signs	Control mode	Setting value of Pr0.01
P	Position control	0
S	Speed control	1
T	Torque control	2
P/S	Position (first) speed (second) control	3*
P/T	Position (first) torque (second) control	4*
S/T	Speed (first) torque (second) control	5*
F	Choose an encoder in the state	6

Note:

When setting the combination mode of 3,4,or 5, select the first or the second mode according to the control mode switching input (C-MODE).
C-MODE is OFF: select the 1st mode
C-MODE is ON: select the 2nd mode
Do not enter the command within 10ms before / after the switching.

4.2.3 List of parameters

[Class 0] Basic setting:

Parameter No.		Name	Setting range	Standard factory default	Unit	Switch on again	Correlation model			
classification	No.						P	S	T	F

0	00	Rotation direction setting	0∽1	1	-	○	○	○	○	○
0	01	Control mode setting	0∽6	0	-	○	○	○	○	○
0	02	Real-time automatic adjustment setting	0∽6	1	-		○	○	○	○
0	03	Selection of machine stiffness at real-time auto-gain tuning	0∽31	13	-		○	○	○	○
0	04	Ratio of inertias	0∽10000	250	%		○	○	○	○
0	05	Selection of command pulse input	0∽2	0	-	○	○			○
0	06	Command pulse rotational direction setup	0∽1	0	-	○	○			○
0	07	Command pulse input mode setup	0∽3	1	-	○	○			○
0	08	Number of command pulses per circle of motor rotation	0∽ 2^{23}	10000	pulse	○	○			
0	09	1st numerator of electronic gear	0∽ 2^{30}	0			○			○
0	10	De	1∽ 2^{30}	10000			○			○
0	11	Number of output pulses per circle of motor rotation	1∽2097152	2500	P/r	○	○	○	○	○
0	12	Reversal of pulse output logic	0∽3	0	-	○	○	○	○	○
0	13	First torque limit	0∽500	350	%		○	○	○	○
0	14	Position deviation excess setup	0∽ 2^{30}	100000	Command unit		○			○
0	15	Absolute encoder setup	0∽4	1	-	○	○	○	○	○
0	16	External regenerative resistor setup	0∽3	0	-	○	○	○	○	○
0	17	Load factor of external regenerative resistor selection	0∽4	0	-	○	○	○	○	○

TIPS Note:

1. For the parameters marked "O" in "Switch on again", after the parameter is changed, the parameter can take effect after power off and restart.
2. For the items in "Related modes", P: position control; S: speed control; T: torque control.

[Class 1] Gain adjustment:

Parameter No.		Name	Setting range	Standard factory default	Unit	Switch on again	Correlation model			
classification	No.						P	S	T	F
1	00	1st gain of position loop	0-3000	48.0	1/s		○			○
1	01	1st gain of velocity loop	0.1-3276.7	27.0	Hz		○	○	○	○
1	02	1st time constant of velocity loop integration	0.1-1000	21.0	ms		○	○	○	○
1	03	1st filter of speed detection	0∽25	0.10	ms		○	○	○	○
1	04	1st time constant of torque filter	0∽25.00	0.40	ms		○	○	○	○
1	05	2nd gain of position loop	0∽3000.0	57.0	1/s*		○			○
1	06		0.1∽3276.7	27.0	Hz*		○	○	○	○

		2nd gain of velocity loop								
1	07	2nd time constant of velocity loop integration	0.1～1000	21.0	ms*		○	○	○	○
1	08	2nd filter of speed detection	0～25	0.10	ms		○	○	○	○
1	09	2nd time constant of torque filter	0～25	0.40	ms*		○	○	○	○
1	10	Speed feedforward gain	0～200	100	%*		○			○
1	11	Speed feedforward filter	0～64	0.00	ms*		○			○
1	12	Torque feedforward gain	0～200	100	%*		○	○		○
1	13	Torque feedforward filter	0～64	1.00	ms*		○	○		○
1	14	Second gain setup	0～1	1	-		○	○	○	○
1	15	Mode of position control switching	0～10	0	-		○			○
1	16	Delay time of position control switching	0～1000.0	1.0	ms*		○			○
1	17	Level of position control switching	0～2000.0	0	-		○			○
1	18	Hysteresis at position control switching	0～20000	0	-		○			○
1	19	Position gain switching time	0～1000.0	1.0	ms*		○			○
1	20	Mode of velocity control switching	0～5	0	-			○		
1	21	Delay time of velocity control switching	0～1000.0	0.0	ms*			○		
1	22	Level of velocity control switching	0～20000	0	-			○		
1	23	Hysteresis at velocity control switching	0～20000	0	-			○		
1	24	Mode of torque control switching	0～3	0	-				○	
1	25	Delay time of torque control switching	0～1000.0	0.0	ms*				○	
1	26	Level of torque control switching	0～20000	0	-				○	
1	27	Hysteresis at torque control switching	0～20000	0	-				○	

Note:

1. For the parameters marked "O" in "Switch on again", after the parameter is changed, the parameter can take effect after power off and restart.

2. For the items in "Related modes", P: position control; S: speed control; T: torque control.

[Class 2] Vibration control function

Parameter No.		Name	Setting range	Standard factory default	Unit	Switch on again	Correlation model			
classification	No.						P	S	T	F
2	00	Adaptive filter mode setup	0～6	0	-		○	○		○
2	01	First notch frequency	50～5000	5000	Hz		○	○	○	○
2	02	First notch width selection	0～20	2	-		○	○	○	○
2	03	First notch depth selection	0～99	0	-		○	○	○	○
2	04	Second notch frequency	50～5000	5000	Hz		○	○	○	○
2	05	Second notch width selection	0～20	2	-		○	○	○	○
2	06	Second notch depth selection	0～99	0	-		○	○	○	○
2	07	Second notch frequency	50～5000	5000	Hz		○	○	○	○
2	08	Third notch width selection	0～20	2	-		○	○	○	○
2	09	Third notch depth selection	0～99	0	-		○	○	○	○
2	10	4th notch frequency	50～5000	5000	Hz		○	○	○	○
2	11	4th notch width selection	0～20	2	-		○	○	○	○
2	12	4th notch depth selection	0～99	0	-		○	○	○	○
2	13	Selection damping filter switching	0～6	0	-		○			○
2	14	First vibration control frequency	0～30	0	Hz		○			○
2	15	First vibration control damp setup	0～1	0	-		○			○
2	16	2nd vibration control frequency	0～30	0	Hz		○			○
2	17	2nd vibration control damp setup	0～1	0	-		○			○
2	18	3rd vibration control frequency	0～30	0	Hz		○			○
2	19	3rd vibration control damp setup	0～1	0	-		○			○
2	20	4th vibration control frequency	0～30	0	Hz		○			○
2	21	5th vibration control damp setup	0～1	0	-		○			○
2	22	Positional command smoothing filter	0～1000	9.2	ms*		○	○		○
2	23	Positoinal command FIR filter	0～1000	1	ms*		○			○
2	24	5th notch frequency	50～5000	5000	Hz		○	○	○	○
2	25	5th notch width	0～20	2	-		○	○	○	○
2	26	5th notch depth	0～99	0	-		○	○	○	○
2	27	First vibration control width setting	0-1000	0	-		○			○
2	28	Second vibration control width setting	0-1000	0	-		○			○
2	29	Third vibration control width setting	0-1000	0	-		○			○
2	30	Fourth vibration control width setting	0-1000	0	-		○			○

TIPS Note:

1. For the parameters marked "O" in "Switch on again", after the parameter is changed, the parameter can take effect after power off and restart.
2. For the items in "Related modes", P: position control; S: speed control; T: torque control.

[Class 3] Speed and torque control

Parameter No.	Name	Setting range	Standard	Unit	Switch on	Correlation model

classification	No.			factory default		again	P	S	T	F
3	00	Speed setup, Internal/External switching	0～3	0	-			○		
3	01	Speed command rotational direction selection	0～1	0	-			○		
3	02	Input gain of speed command	10～2000	500	(rpm)/V			○	○	
3	03	Reversal of speed command input	0～1	1	-			○		
3	04	1st speed of speed setup	-20000～20000	0	rpm			○		
3	05	2nd speed of speed setup	-20000～20000	0	rpm			○		
3	06	3rd speed of speed setup	-20000～20000	0	rpm			○		
3	07	4th speed of speed setup	-20000～20000	0	rpm			○		
3	08	5th speed of speed setup	-20000～20000	0	rpm			○		
3	09	6th speed of speed setup	-20000～20000	0	rpm			○		
3	10	7th speed of speed setup	-20000～20000	0	rpm			○		
3	11	8th speed of speed setup	-20000～20000	0	rpm			○		
3	12	Acceleration time setup	0～10000	0	ms/krpm			○		
3	13	Acceleration time setup	0～10000	0	ms/krpm			○		
3	14	Sigmoid acceleration/deceleration time setup	0～1000	0	ms			○		
3	15	Speed zero-clamp function selection	0～3	0	-			○	○	
3	16	Speed zero clamp level	10～20000	30	rpm			○	○	
3	17	Selection of torque command	0～2	0	-				○	
3	18	Torque command direction selection	0～1	0	-				○	
3	19	Input gain of torque command	1～10	3	V/%*				○	
3	20	Input reversal of torque command	0～1	0	-				○	
3	21	Speed limit value 1	0～20000	0	rpm				○	
3	22	Speed limit value 2	0～20000	0	rpm				○	
3	23	External scale selection	0	0	-		○			○
3	24	Numerator of external scale division	0-16777216		-		○			○
3	25	Denominator if external scale division	0-16777216		-		○			○
3	26	Reversal of direction of external scale	0-1		-		○			○
3	27	Extern scale Z phase disconnection detecion disable	0-1		-		○			○
3	28	Hybrid deviation excess setup	$1\text{-}2^{27}$		Command unit		○			○
3	29	Hybrid deviation clear setup	0-100		Circle		○			○

Note:

1. For the parameters marked "O" in "Switch on again", after the parameter is changed, the parameter can take effect after power off and restart.

2. For the items in "Related modes", P: position control; S: speed control; T: torque control.

[Class 4] I/F monitor setting

Parameter No.		Name	Setting range	Standard factory default	Unit	Switch on again	Correlation model			
classification	No.						P	S	T	F
4	00	SI1 input selection	0-16777215	8553090	-	○	○	○	○	○
4	01	SI2 input selection	0-16777215	8487297	-	○	○	○	○	○
4	02	SI3 input selection	0-16777215	9539850	-	○	○	○	○	○
4	03	SI4 input selection	0-16777215	394758	-	○	○	○	○	○
4	04	SI5 input selection	0-16777215	4108	-	○	○	○	○	○
4	05	SI6 input selection	0-16777215	197379	-	○	○	○	○	○
4	06	SI7 input selection	0-16777215	3847	-	○	○	○	○	○
4	07	SI8 input selection	0-16777215	263172	-	○	○	○	○	○
4	08	SI9 input selection	0-16777215	328965	-	○	○	○	○	○
4	09	SI10 input selection	0-16777215	3720	-	○	○	○	○	○
4	10	SO1 output selection	0-16777215	197379	-	○	○	○	○	○
4	11	SO2 output selection	0-16777215	131586	-	○	○	○	○	○
4	12	SO3 output selection	0-16777215	65793	-	○	○	○	○	○
4	13	SO4 output selection	0-16777215	328964	-	○	○	○	○	○
4	14	SO5 output selection	0-16777215	460551	-	○	○	○	○	○
4	15	SO6 output selection	0-16777215	394758	-	○	○	○	○	○
4	16	Type of analog monitor 1	0～28	0	-		○	○	○	○
4	17	Output gain of analog monitor 1	0-214748364	0	-		○	○	○	○
4	18	Type of analog monitor 2	0-28	4	-		○	○	○	○
4	19	Output gain of analog monitor 2	0-214748364	0	-		○	○	○	○
4	20	For manufactuer's use	0～3	0	-					○
4	21	Analog monitor output setup	0～2	0	-		○	○	○	
4	22	Analog input 1(AI1) offset setup	-10000-10000	0	mV		○	○	○	○
4	23	Analog input 1 (AI1) filter	0～64	0	ms*		○	○	○	○
4	24	Analog input 1(AI1) overvoltage setup	0～10	0	V*		○	○	○	○
4	25	Analog input 2(AI2) offste setup	-10000-10000	0	mV		○	○	○	○
4	26	Analog input 2 (AI2) filter	0～64	0	ms*		○	○	○	○
4	27	Analog input 2 (AI2) overvoltage setup	0～10	0	V*		○	○	○	○
4	28	Analog input 3(AI3) offset setup	-10000-10000	0	mV		○	○	○	○
4	29	Analog input 3 (AI3) filter	0～64	0	ms*		○	○	○	○
4	30	Analog input 3(AI3) overvoltage setup	0～10	0	V*		○	○	○	○
4	31	Positioning complete(in-position) range	0～2097152	10	-		○			○
4	32	Positioninig complete(In-position) output setup	0～10	0	-		○			○
4	33	INP hold time	0～30000	0	ms		○			○
4	34	Zero speed	10～20000	50	rpm		○	○	○	○
4	35	Speed conincidence range	10～20000	50	rpm			○	○	
4	36	At-speed(Speed arrival)	10～20000	1000	rpm			○	○	
4	37	Mechanical brake action at stalling setup	0～10000	0	ms		○	○	○	○
4	38	Mechanical brake action at running	0～32000	0	ms		○	○	○	○

		setup								
4	39	Brake release speed settup	30-3000	30	rpm		○	○	○	○
4	40	Selection of alarm output 1	0∽28	0	-		○	○	○	○
4	41	Selection of alarm output 2	0∽28	0	-		○	○	○	○
4	42	2nd postion compleye(in-position) range					○			○
4	44	Position comparison output pulse width setting	0-3276.7	0	ms	○	○			○
4	45	Position comparison output polarity select			-	○	○			○
4	47	Pulse output select	0-7	0	-	○	○	○	○	○
4	48	Position compare value 1	-2147483648-2147483647	0	Command unit		○			○
4	49	Position compare value 2	-214748364～2147483647	0	Command unit		○			○
4	50	Position compare value 3	-214748364～2147483647	0	Command unit		○			○
4	51	Position compare value 4	-214748364～2147483647	0	Command unit		○			○
4	52	Position compare value 5	-214748364～2147483647	0	Command unit		○			○
4	53	Position compare value 6	-214748364～2147483647	0	Command unit		○			○

Note:

1. For the parameters marked "O" in "Switch on again", after the parameter is changed, the parameter can take effect after power off and restart.
2. For the items in "Related modes", P: position control; S: speed control; T: torque control.

[Class 5] Extension setting

Parameter No.		Name	Setting range	Standard factory default	Unit	Switch on again	Correlation model			
classification	No.						P	S	T	F
5	00	2nd numerator of electronic gear	0∽ 2^{30}	0	-		○			○
5	01	3rd numerator of electronic gear	0∽ 2^{30}	0	-		○			○
5	02	4th numerator of electronic gear	0∽ 2^{30}	0	-		○			○
5	03	Denominator of pulse output division	0∽8388608	0	-	○	○	○	○	○
5	04	Over-travel inhibit input setup	0∽2	1	-	○	○	○	○	○
5	05	Sequence at over-travel inhibit	0∽2	0	-	○	○	○	○	○
5	06	Sequence at Servo-off	0∽9	0	-		○	○	○	○
5	07	Sequence at main power OFF	0∽9	0	-		○	○	○	○
5	08	Lv trip selection at main power OFF	0∽3	0	-		○	○	○	○
5	09	Detection time of main power OFF	70∽2000	70	ms	○	○	○	○	○
5	10	Time sequence at alarm Sequence at alarm	0∽7	0	-		○	○	○	○
5	11	Totque setup for emergence stop	0∽500	0	%		○	○	○	○
5	12	Over-load level setup	0∽500	0	%		○	○	○	○

5	13	Over-speed level setup	0～20000	0	rpm		○	○	○	○
5	14	Motor working range setup	0～100	1	0.1 circle		○			○
5	15	I/F reading filter	0～3	0	-	○	○	○	○	○
5	16	Alarm clear input (A-CLR) setup	0～1	0	-	○	○	○	○	○
5	17	Counter clear input(CL) mode	0～4	3	-		○			○
5	18	Invalid command pulse inhibit input (INH) setup	0～1	1	-		○			○
5	19	Command pulse inhibit input (INH) reading setup	0～5	0	-	○	○			○
5	20	Position setup unit select	0～1	0	-	○	○			○
5	21	Selection of torque limit	0～6	1	-		○	○		○
5	22	2nd torque limit	0～500	300	%		○	○		○
5	23	Torque limit switching setup 1	0～4000	0	ms/100%		○	○		○
5	24	Torque limit switching setup 2	0～4000	0	ms/100%		○	○		○
5	25	External input positive direction torque limit	0～500	300	%		○	○		○
5	26	External input negative direction torque limit	0～500	300	%		○	○		○
5	27	Input gain of analog torque limit	1-10	3	V/100%		○	○		○
5	28	LED initial status	0-42	1	-	○	○	○	○	○
5	29	RS232 baud rate setup	0-7	2	-	○	○	○	○	○
5	30	RS485 baud rate setup	0-7	2	-	○	○	○	○	○
5	31	Axis address	0-127	1	-	○	○	○	○	○
5	32	Command pulse input maximum setup	250-8000	4000	kpulse/s	○	○			○
5	33	Pulse regeneration output limit setup	0-1	0	-	○	○	○	○	○
5	35	Front panel lock setup	0-1	0	-	○	○	○	○	○
5	37	Modbus connection setting	0-2	0	-	○	○	○	○	○
5	38	Modbus communication setting	0-5	0	-	○	○	○	○	○
5	39	Modbus response waiting time	0-10000	0	ms		○	○	○	○
5	40	Modbus communication timeout time	0-10000	0	ms		○	○	○	○
5	42	Mobbus broadcast setting	-32768-32767	0	-		○	○	○	○
5	45	Quadrant projection positive direction compensation value	-100-100	0	%		○			○
5	46	Quadrant projection negative direction compensation value	-100-100	0	%		○			○
5	47	Quadrant projeceion compensation delay time	0-1000	0	ms		○			○
5	48	Quadrant projection compensation filter setting L	0-64	0	ms		○			○
5	49	Quadrant projection compensation filter setting H	0-1000	0	ms		○			○
5	50	Establishment time of quadrant protrusion compensation	0-1000	0	ms		○			○
5	51	Retention time of quadrant protrusion compensation	0-1000	0	ms		○			○
5	56	Deceleration time setting in SlowStop	0-10000	0	ms/(1000rpm)		○			
5	57	S type acceleration and deceleration setting in SlowStop	0-1000	0	Ms		○			

Note:

1. For the parameters marked "O" in "Switch on again", after the parameter is changed, the parameter can take effect after power off and restart.
2. For the items in "Related modes", P: position control; S: speed control; T: torque control.

[Class 6] Special setting

Parameter No.		Name	Setting range	Standard factory default	Unit	Switch on again	Correlation model			
classification	No.						P	S	T	F
6	00	Analog torque feedforward conversion gain	0-10	0	V/100%		○	○		○
6	02	Speed deviation excess setup	0~20000	0	rmp		○			
6	04	JOG trial runcommand speed	0~500	300	rmp		○	○	○	○
6	05	Position control 3rd gain effective time	0-1000	0	ms		○			○
6	06	Position control 3rd gain scale fator	50-1000	100	%		○			○
6	07	Additional value to torque command	-100-100	0	%		○	○		○
6	08	Torque compensation value in positive direction	-100-100	0	%		○			○
6	09	Torque compensation value in negative direction	-100-100	0	%		○			○
6	10	Function extension setup	-32768-32767	16	-		○	○	○	○
6	11	Current response setup	10~100	100	%					
6	13	Second inertia ratio	0-10000	250	%		○	○	○	○
6	14	Immediate stop time at the time of alarming	0~1000	200	ms		○	○	○	○
6	15	2nd over-speed level setup	0~20000	0	rmp		○	○	○	○
6	17	Front panel parameter writring selection	0-1	0	s	○	○	○	○	○
6	18	Power turn-on wait time	0-10	0	pulse	○	○	○	○	○
6	19	Encoder Z-phase setup	0-32767	0	us	○	○			○
6	22	A,Bphase external scale pulse output method selection	0~1	0	-	○				○
6	23	Load fluctuation correction gain	-100-100	0	%		○	○		
6	24	Load flutuation correction filter	0.1-25	0.53	ms		○	○		○
6	27	Alarm latch time selection	0~10	5	s	○	○	○	○	○
6	28	Special function selection	0~1	0	-	○	○			○
6	38	Alarm mask setup	-32768-32767	4	–	○	○	○	○	○
6	39	Alarm mask setup2	–	0	–					
6	50	Viscous friction compensation gain	0-1000	0	%/(1000rpm)		○	○		○
6	51	Immediate stop completion wait time	0~10000	0	ms		○	○	○	○
6	57	Torque saturation error protection detection time	0~5000	0	ms		○	○		○

Note:

1. For the parameters marked "O" in "Switch on again", after the parameter is changed, the parameter can take effect after power off and restart.
2. For the items in "Related modes", P: position control; S: speed control; T: torque control.

4.2.4 Torque limit setting

Torque limit setting range and standard factory default. The setting range is 0～500 and the standard factory default depends on the specific driver model.

Note:

Pr0.13 First torque limit, Pr5.22 Second torque limit, Pr5.11 Torque setting when instant stop occurs, Pr5.25 Positive torque limit on external input and Pr5.26 Negative torque limit on external input are the above limited objects.

The maximum value above will change with the motor type. Confirm the set values of Pr0.13, Pr5.22, Pr5.11, Pr5.25 and Pr5.26 again before setting.

■ Precautions when switching motors

To sum up, when the combination of driver and motor changes, the setting range of torque limit will also change. Please pay attention to the following:

● Motor torque limit

After the series or power change of motor is changed, the torque limit set value (see Example 1) must be set again as it is different from the rated torque of the motor before change.

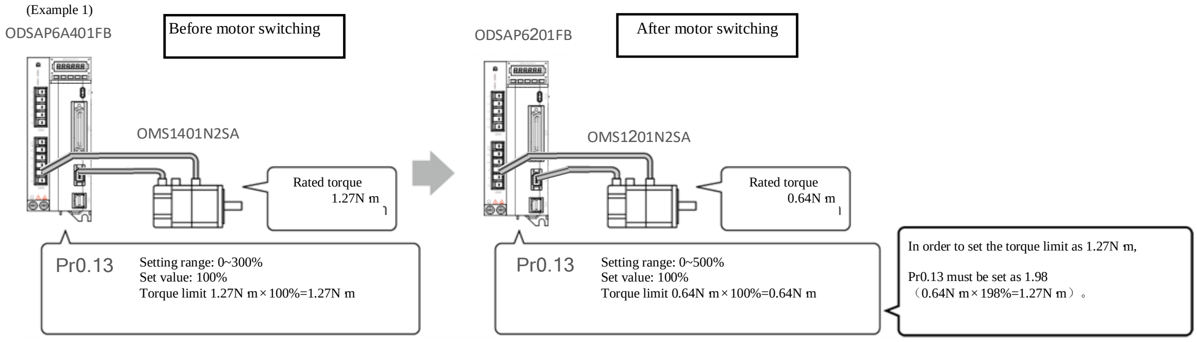


Fig. 4.2.4-1 Motor torque limit

● Maximum motor torque output

Since the upper limit of the torque limit setting range changes before and after exchange, please set the upper torque limit again (see Example 2).

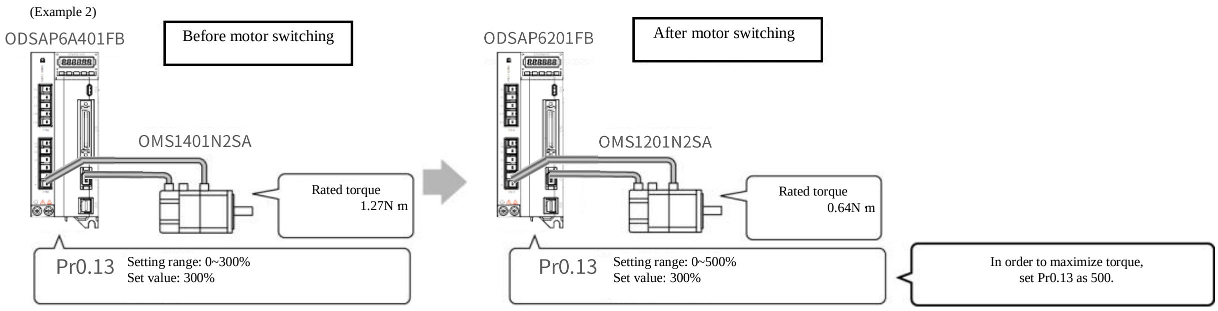


Fig. 4.2.4-2 Maximum motor torque output

TIPS

Note:

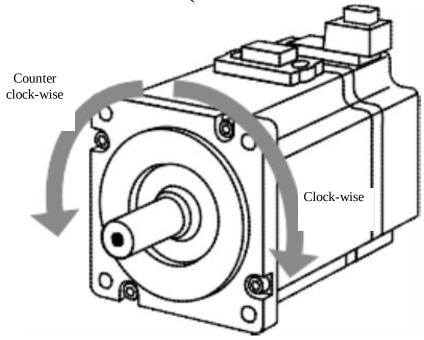
Do not use any motor or driver other than the specified matching combination.

4.3 Parameter group

4.3.1 Group Pr00 parameters

No.	Name	Rotation direction setting			Setting enabled	Re-electrifying	Data range	0-1
Pr0.00*	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

Setup the relationship between the direction of command and direction of motor rotation.
0: Motor turns CW in response to positive direction command (CW when viewed from load side shaft end)
1: Motor turns CCW in response to positive direction command (CCW when viewed from load side shaft end)



Factory default

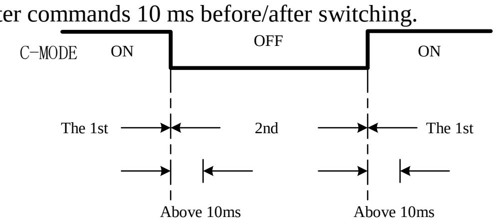
Set value	Command direction	Motor rotational direction	Positive direction drive inhibit input	Negative direction drive inhibit input
0	Positive direction	CW	Valid	-
	Negative direction	CCW	-	Valid
1	Positive direction	CCW	Valid	-
	Negative direction	CW	-	Valid

No.	Name	Control mode setup			Setting enabled	Re-electrifying	Data range	0-6
Pr0.01*	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Setup the control mode to be used.

Set value	Content	
	Mode 1	Mode 2
[0]	Position	-
1	Velocity	-
2	Torque	-
3※1	Position	Speed
4※1	Position	Torque
5※1	Velocity	Torque
6	Full-closed loop	-

※When you set up the combination mode of 3,4 or 5, you can select either the 1st or the 2nd with control mode switching input (C-MODE).
When C-MODE is open, the 1st mode will beselected.
When C-MODE is shorted, the 2nd mode will be selected.
Don't enter commands 10 ms before/after switching.



The waveform above shows when logical setting of C-MODE input is a-contact.
When b-contact is used, open and short is reversed.

No. Pr0.02	Name	Real-time auto-gain tuning setup			Setting enabled	Immediately enabled	Data range	0-6
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

Set up the action mode of real-time auto-gain tuning. Please refer to "Auto-gain tuning" in the servo tuning part.

Set value	Mode	Description
0	Invalid	Real-time auto-gain tuning function is disabled.
1	Standard response mode	Stability oriented mode. Do not use unbalanced load, friction compensation or gain switching.
2	Positioning response mode	Main application is positioning..It is recommended to use this mode on equipment without unbalanced horizontal axis, ball screw driving equipment with low friction, etc.
3	Vertical axis response mode	With additional features to the positioning mode-use this mode to positively and effectively compensate for unbalanced load to the vertical axis or minimize variations in setting time.
4	Friction compensation response mode	With additional features to the vertical axis mode - use this mode to positively and effectively reduce positioning setting time when the belt driving axis has high friction.
5	Load characteristic measurement	Estimate the load characteristics without changing the basic gain setting and friction compensation setting. This mode requires use of the Debugging software.
6	Fit gain mode	To be used for fine adjustment of rigidity setting after completion of fit gain

No. Pr0.03	Name	Selection of machine stiffness at real-time auto-gain tuning			Setting enabled	Immediately enabled	Data range	0-31
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	13

set up the response while the real-time auto-gain tuning is valid.

Low ← Mechanical rigidity → High

Low ← Servo rigidity → High

0 • 1 ---- 11 – 13 -------------- 30 • 31

Low ← Responsiveness → High

Note:

1. Higher the setup value, higher the velocity response and servo stiffness will be obtained.However, when increasing the value, check the resulting operation to avoid oscillation or vibration.
2. Control gain is updated while the motor is stopped. If the motor cannot be stopped due to excessively low gain or continuous application of one-way direction command, any change made to Pr0.03 “Selection of machine stiffness at real-time auto-gain tuning” is not used for update. If the changed stiffness setting is made valid after the motor stopped, abnormal sound or oscillation will be generated. To prevent this problem, stop the motor after changing the stiffness setting and check that the changed setting is enabled.

<table>
<tr><td rowspan="2">No.
Pr0.04</td><td>Name</td><td colspan="3">Inertia ratio</td><td>Setting enabled</td><td>Immediately enabled</td><td>Data range</td><td>0-10000</td></tr>
<tr><td>Accessibility</td><td>RW</td><td>Unit</td><td>%</td><td>Correlation model</td><td>ALL</td><td>Factory default</td><td>250</td></tr>
</table>

Set the first inertia ratio.
Set up the ratio of load inertia to the rotor inertia of the motor.

$$Pr0.04 = (\text{load inertia/rotor inertia}) \times 100\text{"\%"}$$

The inertia ratio will be estimated at all time while the real-time auto-gain tuning is valid, and its result will be saved to EEPROM every 30 min.

TIPS Note:

If the inertia ratio is correctly set, the setup unit of Pr1.01 and Pr1.06 becomes (Hz). When the inertia ratio of Pr0.04 is larger than the actual, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr0.04 is smaller than the actual, the setup unit of the velocity loop gain becomes smaller.

<table>
<tr><td rowspan="2">No.
Pr0.05*</td><td>Name</td><td colspan="3">Selection of command pulse input</td><td>Setting enabled</td><td>Re-electrifying</td><td>Data range</td><td>0-2</td></tr>
<tr><td>Accessibility</td><td>RW</td><td>Unit</td><td>-</td><td>Correlation model</td><td>ALL</td><td>Factory default</td><td>0</td></tr>
</table>

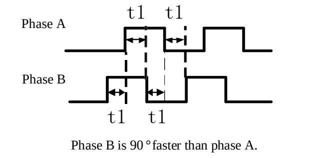
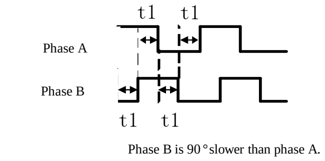
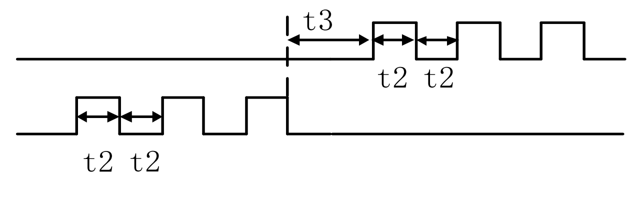
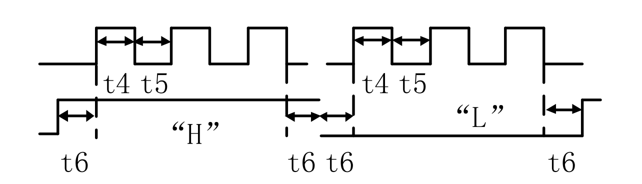
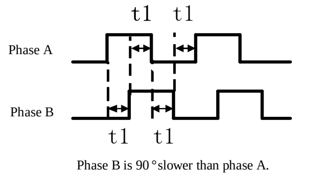
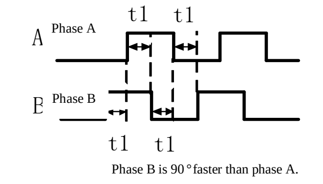
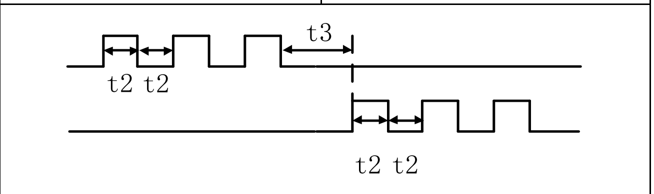
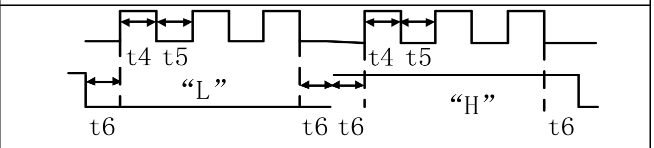
Ω6 according to pulse specifications,you can choose any one of the most appropriate interface from the two interfaces.
When using open collerctor I/F,Pr0.05=2 that is recommended.
For command pulse input ,you can select either the photocoupler input or the exclusive input for line driver as the command pulse input.

Set value	Content	Interface PIN NO	Signal name
[0]	Photocoupler input Both line driver and open collector ・Line driver (Permissible max frequency inputs:500 kpps) ・Open collector (Permissible max. input frequency:200 kpps	No.1 No.3 No.4 No.2 No.5 No.6	OPC1 PULS1 PULS2 OPC2 SIGN1 SIGN2
1	Exclusive input for line driver ・Line driver (Permissible max. input frequency: 4 Mpps)	No.44 No.45 No.46 No.47	PULSH1 PULSH2 SIGNH1 SIGNH2
2	Photocoupler inputs ・Open collector (Permissible max. input frequency:200 kpps)	No.1 No.3 No.4 No.2 No.5 No.6	OPC1 PULS1 PULS2 OPC2 SIGN1 SIGN2

Pelese refer to 2.13.3.2 of Chapter 2.

<table>
<tr><td rowspan="2">No.
Pr0.06*</td><td>Name</td><td colspan="3">Command pulse rotational direction setup</td><td>Setting enabled</td><td>Re-electrifying</td><td>Data range</td><td>0-1</td></tr>
<tr><td>Accessibility</td><td>RW</td><td>Unit</td><td>-</td><td>Correlation model</td><td>P</td><td>Factory default</td><td>0</td></tr>
<tr><td rowspan="2">No.
Pr0.07*</td><td>Name</td><td colspan="3">Command pulse input mode setup</td><td>Setting enabled</td><td>Re-electrifying</td><td>Data range</td><td>0-3</td></tr>
<tr><td>Accessibility</td><td>RW</td><td>Unit</td><td>-</td><td>Correlation model</td><td>P</td><td>Factory default</td><td>1</td></tr>
</table>

The table below shows combinations of Pr0.06 Command pulse rotational direction setup and Pr0.07 Command pulse input mode setup.
Pulses are counted at edges indicated by the arrows as shown in the table.

<table>
<tr><th>• Input format command pulsePr0.06 (Command pulse rotational direction setup)</th><th>Pr0.07 (Command pulse input mode setup)</th><th>Command pulse form</th><th>Signal Name</th><th>Positive direction command</th><th>Negative direction command</th></tr>
<tr><td rowspan="3">[0]</td><td>0 or 2</td><td>90 °phase difference 2-phase pulse (A + B-Phase)</td><td>PULS SIGN</td><td>
</td><td>
</td></tr>
<tr><td>[1]</td><td>Positive direction pulse train + Negative direction pulse train</td><td>PULS SIGN</td><td colspan="2">
</td></tr>
<tr><td>3</td><td>Pulse train + Signal</td><td>PULS SIGN</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">1</td><td>0 or 2</td><td>90 °phase difference 2-phase pulse (A + B-Phase)</td><td>PULS SIGN</td><td>
</td><td>
</td></tr>
<tr><td>[1]</td><td>Positive direction pulse train + Negative direction pulse train</td><td>PULS SIGN</td><td colspan="2">
</td></tr>
<tr><td>3</td><td>Pulse train + Signal</td><td>PULS SIGN</td><td colspan="2">
</td></tr>
</table>

• Permissible max. input frequency, and min. necessary time width of command pulse input signal.

<table>
<tr><th colspan="2" rowspan="2">Input I/F of PULS/SIGN signal</th><th rowspan="2">Permissible max. input frequency</th><th colspan="6">Min. necessary time width (μs)</th></tr>
<tr><th>t1</th><th>t2</th><th>t3</th><th>t4</th><th>t5</th><th>t6</th></tr>
<tr><td rowspan="2">PULSH1、2
SIGNH1、2</td><td>A,B-phase input,afer multiplied by 4</td><td>16Mpps</td><td>0.0625</td><td>0.0625</td><td>0.0625</td><td>0.0625</td><td>0.0625</td><td>0.0625</td></tr>
<tr><td>A,B-phase input except</td><td>4Mpps</td><td>0.25</td><td>0.125</td><td>0.125</td><td>0.125</td><td>0.125</td><td>0.125</td></tr>
</table>

PULSH1、2 SIGNH1、2	Line driver interface	500kpps	2	1	1	1	1	0.5
	Open collector interface	200kpps	5	2.5	2.5	2.5	2.5	2.5

Make the rising/falling time of the command pulse input signal to 0.1 μs or smaller.
When parameter Pr0.07=0 or 2,if parameter Pr0.08=10000,2 phase pulse input 2500 pulse per one motor revolution.
When parameter Pr0.07=1 or 3,if parameter Pr0.08=10000,there is a single pulse in PULSE and SIGN,so input 10000 pulse per one motor revolution..

No. Pr0.08*	Name	Command pulse counts per one motor revolution			Setting enabled	Re-electrifying	Data range	0-16777216
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	10000

Set the command pulses that causes single turn of the motor shaft.
When this setting is 0, Pr0.09 1st numerator of electronic gear and Pr0.10 Denominator of electronic gear become valid.

No. Pr0.09	Name	1st numerator of electronic gear			Setting enabled	Immediately enabled	Data range	$0\text{-}2^{30}$
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set the numerator of division/multiplication operation made according to the command pulse input.
This setup is enabled when Pr0.08 command pulse counts per one motor revolution = 0.

No. Pr0.10	Name	Denominator of electronic gear			Setting enabled	Immediately enabled	Data range	$1\text{-}2^{30}$
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	10000

Set the Denominator of division/multiplication operation made according to the command pulse input.
This setup is enabled when Pr0.08 command pulse counts per one motor revolution = 0.

<Interrelationship between Pr0.08, Pr0.09 and Pr0.10 during Position control>

Pr0.08	Pr0.09	Pr0.10	Command division/multiplication operation
1-8388608	— (No effect)	— (No effect)	Command pulse input $\rightarrow \dfrac{\text{Encoder resolution}}{\text{[Set value of Pr0.08]}} \rightarrow$ Position order * Regardless of setup of Pr0.09 and Pr0.10, this operation is processed according to setup value of Pr0.08.
0	0	1-1073741824	Command pulse input $\rightarrow \dfrac{\text{Encoder resolution}}{\text{[Set value of Pr0.10]}} \rightarrow$ Position order * When both Pr0.08 and Pr0.09 are set to 0, this operation is processed according to setup value of Pr0.10.
	1-1073741824	1-1073741824	Command pulse input $\rightarrow \dfrac{\text{[Set value of Pr0.09]}}{\text{[Set value of Pr0.10]}} \rightarrow$ Position order * When setup value of Pr0.08 is 0, and Pr0.09≠0, this operation is processed according to setup value of Pr0.09 and Pr0.10.

<Interrelationship between Pr0.08, Pr0.09 and Pr0.10 during full closed control>

Pr0.08	Pr0.09	Pr0.10	Command frequency division processing
(Invalid)	0	1-1073741824	Command pulse input $\rightarrow \dfrac{1}{1} \rightarrow$ Position order * If Pr0.09 is 0 during full closed controlling, the process as shown above is performed with both numerator and

			denominator set to 1.
	1-1073741824	1-1073741824	Command pulse input → $\frac{\text{[Set value of Pr0.09]}}{\text{[Set value of Pr0.10]}}$ → Position order * When setup value of Pr0.09≠0, this operation is processed according to setup value of Pr0.09 and Pr0.10.

TIPS Note:

The desired setting can be determined by selecting value of numerator and denominator of electronic gear. However, an excessively high division or multiplication ratio cannot guarantee the operation. The ratio should be in a range between 1/1000 and 8000.

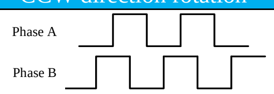
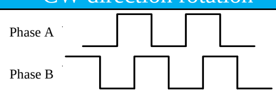
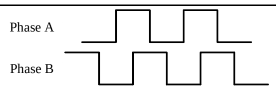
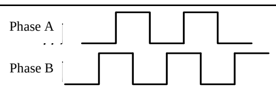
Excessively high multiplication ratio will cause Err27.2 (command pulse multiplication error protection) due to varying command pulse input or noises, even if the other settings are within the specified range.

No. Pr0.11*	Name	Output pulse counts per one motor revolution			Setting enabled	Re-electrifying	Data range	1-2097152
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	2500
Set up the output pulse counts per one motor revolution for each OA and OB .								

No. Pr0.12*	Name	Reversal of pulse output logic			Setting enabled	Re-electrifying	Data range	0-3
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set up the B-phase logic and the output source of the pulse output. With this parameter, you can reverse the phase relation between the A-phase pulse and the B-phase pulse by reversing the B-phase logic. Encoder or external scale can be selected as the output source for full-closed control. The encoder is selected as the source if not for full-closed control.

<Reversal of pulse output logic>

Pr0.12	B-phase logic	Output source	CCW direction rotation	CW direction rotation
[0]	Non-reversal	Encoder		
2		External scale		
1	Reversal	Encoder		
3		External scale		

Note:
Setup value 2 and 3 are valid only for full-closed control. Setting must be 0 or 1 if not for fullclosed control.
The selection of the output source of Z-phase is held concurrently.
Setup value 0 and 1 are Z-phase output of encoder.
Setup value 2 and 3 are Z-phase output of external scale

No. Pr0.13	Name	1st torque limit			Setting enabled	Immediately enabled	Data range	0-500
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	500
Set up the limit value of the motor output torque. Note: For details of torque limit value, refer to section 4.2.4.								

No. Pr0.14	Name	Position deviation excess setup			Setting enabled	Immediately enabled	Data range	1-1073741824
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	100000
•Set excess range of positional deviation by the command unit (default). •Setup unit can be changed to encoder unit through Pr5.20 (position setup unit selection).If the unit is changed, set up with the								

encoder pulse counts at the position control and with the external scale pulse counts at the full-closed control. •Err24.0 (Error detection of position deviation excess) becomes invalid when you set up this to 0. Note: For description of "command unit" and "encoder unit", refer to "Pr5.20".

No. Pr0.15*	Name	Absolute encoder setup			Setting enabled	Re-electrifying	Data range	0-4
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

Set the usage method of 23 bit absolute encoder.

Set value	Function
0	Used as absolute encoder
1	Used as incremental encoder
2	Used as absolute encoder, but multi-turn count overflow can be ignored
3	Used by manufacturer (do not set)
4	Used as an absolute system(absolute mode); however,any value can be set for the upper limit of the multi-turn counter.(continuous rotating absolute encoder mode)

No. Pr0.16*	Name	External regenerative resistor setup			Setting enabled	Re-electrifying	Data range	0-3
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

This parameter is set according to the regenerative resistor. With this parameter, you can select either to use the built-in regenerative resistor of the driver, or to separate this built-in regenerative resistor and externally install the regenerative resistor.

Set value	Regenerative resistor to be used	Function
0	Built-in resistor	Regenerative processing circuit will be activated and ,When the duty of regenerative resistor exceeds 1%, the regenerative overload protection (ERR18.0) will be triggered and the regenerative processing circuit will be disactivated
1	External resistor	Start the regenerative braking circuit. When the switching rate of regenerative resistor exceeds 10%, the regenerative overload protection (ERR18.0) will be given an alarm and the braking will be disconnected.
2	External resistor	Regenerative processing circuit is activated, but no regenerative over-load protection is triggered.
3	N/A	Both regenerative processing circuit and regenerative protection are not activated, and built-in capacitor handles all regenerative power.

Install an external protection such as thermal fuse when you use the external regenerative resistor..

Note:
1.Otherwise, the regenerative resistor might be heated up abnormally and result in burnout, regardless of validation or invalidation of regenerative over-load protection.
2.Attention:When you use the built-in regenerative resistor, never to set up other value than 0. Don't touch the external regenerative resistor.External regenerative resistor gets very hot, and might cause burning.

No. Pr0.17*	Name	Load factor of external regenerative resistor selection			Setting enabled	Re-electrifying	Data range	0-4
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

When selecting the external regenerative resistor (Pr0.16 = 1, 2), select the computing method of load factor of regenerative resistor.

Set value	Function
0	Regenerative load factor is 100 % when duty factor of external regenerative resistor is 10 %.
1-4	For manufacturer's use (do not setup)

4.3.2 Group Pr01 parameters

No. Pr1.00	Name	1st gain of position loop			Setting enabled	Immediately enabled	Data range	0-30000
	Accessibility	RW	Unit	0.1/s	Correlation model	P/S	Factory default	480

You can determine the response of the positional control system.
Higher the gain of position loop you set, faster the positioning time you can obtain. Note that too high setup may cause oscillation.

No. Pr1.01	Name	1st gain of velocity loop			Setting enabled	Immediately enabled	Data range	1-32767
	Accessibility	RW	Unit	0.1Hz	Correlation model	ALL	Factory default	270

You can determine the response of the velocity loop.
In order to increase the response of overall servo system by setting high position loop gain,you need higher setup of this velocity loop gain as well. However, too high setup may cause oscillation.
Note:When the inertia ratio of Pr0.04 is set correctly, the setup unit of Pr1.01 becomes (Hz).

No. Pr1.02	Name	1st time constant of velocity loop integration			Setting enabled	Immediately enabled	Data range	1-10000
	Accessibility	RW	Unit	0.1ms	Correlation model	ALL	Factory default	210

You can set up the integration time constant of velocity loop.
Smaller the setup, faster you can dog-in deviation at stall to 0.
The integration will be maintained by setting to "9999".
The integration effect will be lost by setting to "10000".

No. Pr1.03	Name	1st filter of speed detection			Setting enabled	Immediately enabled	Data range	0-2500
	Accessibility	RW	Unit	0.01ms	Correlation model	P/S	Factory default	0

You can set up the time constant of the low pass filter (LPF) after the speed detection.
Higher the setup, larger the time constant you can obtain so that you can decrease the motor noise, however, response becomes slow.
Use with a default value of 0 in normal operation.

No. Pr1.04	Name	1st time constant of torque filter			Setting enabled	Immediately enabled	Data range	0-2500
	Accessibility	RW	Unit	0.01ms	Correlation model	ALL	Factory default	40

You can set up the time constant of the 1st delay filter inserted in the torque command portion. You might expect suppression of oscillation caused by distortion resonance.

No. Pr1.05	Name	2nd gain of position loop			Setting enabled	Immediately enabled	Data range	0-30000
	Accessibility	RW	Unit	0.1/s	Correlation model	P	Factory default	480

You can determine the response of the positional control system.
Higher the gain of position loop you set, faster the positioning time you can obtain. Note that too high setup may cause oscillation.

No. Pr1.06	Name	2nd gain of velocity loop			Setting enabled	Immediately enabled	Data range	0-32767
	Accessibility	RW	Unit	0.1Hz	Correlation model	ALL	Factory default	270

You can determine the response of the velocity loop.
In order to increase the response of overall servo system by setting high position loop gain,you need higher setup of this velocity loop gain as well. However, too high setup may cause oscillation.
Note:When the inertia ratio of Pr0.04 is set correctly, the setup unit of Pr1.01 becomes (Hz).

No. Pr1.07	Name	2nd time constant of velocity loop integration			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	0.1ms	Correlation model	ALL	Factory default	210

You can set up the integration time constant of velocity loop.
Smaller the setup, faster you can dog-in deviation at stall to 0.
The integration will be maintained by setting to "9999".
The integration effect will be lost by setting to "10000".

No. Pr1.08	Name	2nd filter of speed detection			Setting enabled	Immediately enabled	Data range	0-2500
	Accessibility	RW	Unit	0.01ms	Correlation model	P/S	Factory default	0

You can set up the time constant of the low pass filter (LPF) after the speed detection.
Higher the setup, larger the time constant you can obtain so that you can decrease the motor noise, however, response becomes slow.
Use with a default value of 0 in normal operation.

No. Pr1.09	Name	2nd time constant of torque filter			Setting enabled	Immediately enabled	Data range	0-2500
	Accessibility	RW	Unit	0.01ms	Correlation model	ALL	Factory default	40

You can set up the time constant of the 1st delay filter inserted in the torque command portion. You might expect suppression of oscillation caused by distortion resonance.

No. Pr1.10	Name	Velocity feed forward gain			Setting enabled	Immediately enabled	Data range	0-4000
	Accessibility	RW	Unit	0.1%	Correlation model	P	Factory default	1000

Multiply the velocity control command calculated according to the internal positional command by the ratio of this parameter and add the result to the speed command resulting from the positional control process.

No. Pr1.11	Name	Velocity feed forward filter			Setting enabled	Immediately enabled	Data range	0-6400
	Accessibility	RW	Unit	0.01ms	Correlation model	P	Factory default	0

Set the time constant of 1st delay filter which affects the input of velocity feed forward.
<Usage example of velocity feed forward>
The velocity feed forward will become effective as the velocity feed forward gain is gradually increased with the velocity feed forward filter set at approx. 50 (0.5 ms). The positional deviation during operation at a constant velocity is reduced as shown in the equation below in proportion to the value of velocity feed forward gain.

Position deviation [command unit]= command speed [command unit /s]/ position loop gain [1/s])X(100 — speed feed-forward gain[%])/ 100

No. Pr1.12	Name	Torque feed forward gain			Setting enabled	Immediately enabled	Data range	0-2000
	Accessibility	RW	Unit	0.1%	Correlation model	P/S	Factory default	1000

Multiply the torque command calculated according to the velocity control command by the ratio of this parameter and add the result to the torque command resulting from the velocity control process.
Positional deviation at a constant acceleration/deceleration can be minimized close to 0 by increasing the torque forward gain. This means that positional deviation can be maintained at near 0 over entire operation range while driving in trapezoidal speed pattern under ideal condition where disturbance torque is not active.

No. Pr1.13	Name	Torque feed forward filter			Setting enabled	Immediately enabled	Data range	0-6400
	Accessibility	RW	Unit	0.01ms	Correlation model	P/S	Factory default	0

• Set up the time constant of 1st delay filter which affects the input of torque feed forward.
• The torque feed forward will become effective as the torque feed forward gain is gradually increased with the torque feed forward filter is set at approx. 50 (0.5 ms).
<Usage example of torque feed forward>

• To use the torque feed forward, correctly set the inertia ratio. Use the value that was determined at the start of the real time auto tuning, or set the inertia ratio that can be calculated from the machine specification to Pr0.04 Inertia ratio. • The torque feed forward will become effective as the torque feed forward gain is gradually increased with the torque feed forward filter is set at approx. 50 (0.5 ms). • Positional deviation at a constant acceleration/deceleration can be minimized close to 0 by increasing the torque forward gain. This means that positional deviation can be maintained at near 0 over entire operation range while driving in trapezoidal speed pattern under ideal condition where disturbance torque is not active . Note: Zero positional deviation is impossible in actual situation because of disturbance torque. As with the velocity feed forward, large torque feed forward filter time constant decreases the operating noise but increases positional deviation at acceleration change point

No. Pr1.14	Name	2nd gain setup			Setting enabled	Immediately enabled	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

Arrange this parameter when performing optimum adjustment by using the gain switching function

Set value	Gain selection ·switching
0	1st gain is fixed at a value. By using the gain switching input (GAIN), change the velocity loop operation from PI to P. GAIN input photocoupler OFF PI operation GAIN input photocoupler ON P operation * The above description applies when the logical setting of GAIN input is a-contact. ON/OFF of photocoupler is reversed when b-contact.
[1]	Enable gain switching of 1st gain (Pr1.00-Pr1.04) and 2nd gain (Pr1.05- Pr1.09).

Related pages: For switching condition of the 1st and the 2nd, refer to the section "Gain Switching Function" of Adjustment.

No. Pr1.15	Name	Mode of position control switching			Setting enabled	Immediately enabled	Data range	0-10
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set up the triggering condition of gain switching for position control.

Set value	Switching conditions	Gain switching condition
[0]	Fixed to 1st gain	Fixed to the 1st gain (Pr1.00 - Pr1.04)
1	Fixed to 2nd gain	Fixed to the 2nd gain (Pr1.05 - Pr1.09).
2	With gain switching input	• 1st gain when the gain switching input (GAIN) is open. • 2nd gain when the gain switching input (GAIN) is connected to COM-. ※ If no input signal is allocated to the gain switching input (GAIN), the 1st
3	Torque command is large	• Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis) (%) previously with the 1st gain. • Return to the 1st gain when the absolute value of the torque command was kept below (level- hysteresis) (%) previously during delay time with the 2nd gain.
5	Speed command is large	• Valid for position and full-closed controls. • Shift to the 2nd gain when the absolute value of the speed command exceeded (level + hysteresis) (r/min) previously with the 1st gain. • Return to the 1st gain when the absolute value of the speed command was kept below (level- hysteresis) (r/min) previously during delay time with the 2nd gain.
6	Position deviation is large	• Valid for position and full-closed controls. • Shift to the 2nd gain when the absolute value of the positional deviation exceeded (level + hysteresis) (pulse) previously with the 1st gain. • Return to the 1st gain when the absolute value of the positional deviation was kept below(level - hysteresis) (pulse) previously over delay time with the 2nd gain. • Unit of level and hysteresis (pulse) is set as the encoder resolution for positional control and external scale resolution for full-closed control. .
7	Position command exists	• Valid for position and full-closed controls. • Shift to the 2nd gain when the positional command was not 0 previously with the 1st gain. • Return to the 1st gain when the positional command was kept 0 previously during delay time with the 2nd gain.
8	Not in positioning	• Valid for position and full-closed controls.

		complete	• Shift to the 2nd gain when the positioning was not completed previously with the 1st gain. • Return to the 1st gain when the positioning was kept in completed condition previously during delay time with the 2nd gain.
	9	Actual speed is large	• Valid for position and full-closed controls. • Shift to the 2nd gain when the absolute value of the actual speed exceeded (level + hysteresis) (r/min) previously with the 1st gain. • Return to the 1st gain when the absolute value of the actual speed was kept below (level - hysteresis) (r/min) previously during delay time with the 2nd gain..
	10	Position command exists + Actual speed	• Valid for position and full-closed controls. • Shift to the 2nd gain when the positional command was not 0 previously with the 1st gain. • Return to the 1st gain when the positional command was kept at 0 during the delay time and the absolute value of actual speed was kept below (level - hysteresis) (r/min) previously with the 2nd gain.

No. Pr1.16	Name	Delay time of position control switching			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	0.1ms	Correlation model	P	Factory default	Accessibility

For position controlling : When shifting from the 2nd gain to the 1st gain with Pr1.15 Position control switching mode set at 3, 5, 6, 7, 8, 9 or 10, set up the delay time from trigger detection to the switching operation..

No. Pr1.17	Name	Level of position control switching			Setting enabled	Immediately enabled	Data range	0-20000
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

For position controlling: Set up triggering level when Pr1.15 Position control switching mode is set at 3, 5, 6, 9 or 10.
Unit of setting varies with switching mode.
Note:
Set the level equal to or higher than the hysteresis.

No. Pr1.18	Name	Hysteresis at position control switching			Setting enabled	Immediately enabled	Data range	0-20000
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

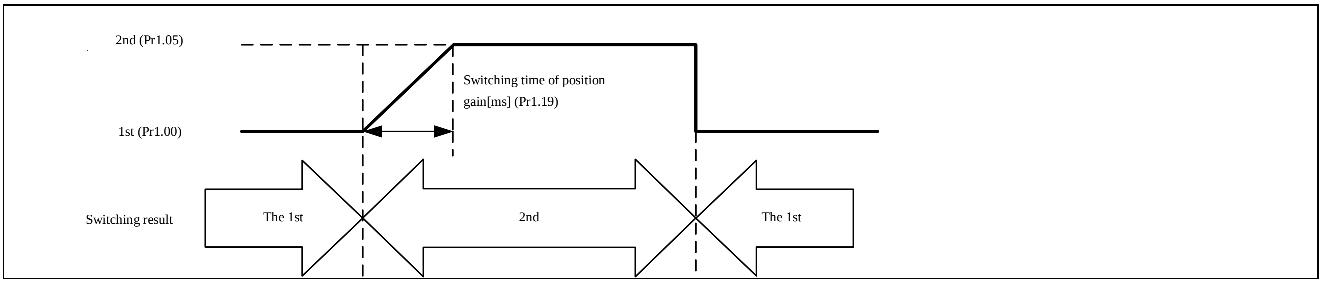
For position controlling: Set up triggering hysteresis when Pr1.15 Position control switching mode is set at 3, 5, 6, 9 or 10.
Unit of setting varies with switching mode.
Note:
When level < hysteresis, the hysteresis is internally adjusted so that it is equal to level.

No. Pr1.19	Name	Position gain switching time			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	0.1ms	Correlation model	P	Factory default	10

For position controlling: If the difference between Pr1.00 1st gain of position loop and Pr1.05 2nd gain of poison loop is large, the increasing rate of position loop gain can be limited by this parameter.
The position loop gain will increase over the time set.

<Position gain switching time>

When using position control and full-closed control, gain of position loop rapidly changes,causing torque change and vibration. By adjusting Pr1.19 Position gain switching time,increasing rate of the poison loop gain can be decreased and vibration level can be reduced.
Note:
Setting of this parameter does not affect the gain switching time when the gain of position loop is switched to lower level (gain is switched immediately).
Example: 1st (Pr1.00) > 2nd (Pr1.05)



<table>
<tr><td rowspan="2">No.
Pr1.20</td><td>Name</td><td colspan="3">Mode of velocity control switching</td><td>Setting enabled</td><td>Immediately enabled</td><td>Data range</td><td>0-5</td></tr>
<tr><td>Accessibility</td><td>RW</td><td>Unit</td><td>-</td><td>Correlation model</td><td>S</td><td>Factory default</td><td>0</td></tr>
</table>

For velocity controlling: Set the condition to trigger gain switching.

Set value	Switching conditions	Gain switching condition
[0]	Fixed to the 1st gain	Fixed to the 1st gain (Pr1.00 - Pr1.04).
1	Fixed to the 2nd gain	Fixed to the 2nd gain (Pr1.05 - Pr1.09).
2	Gain switching input	• 1st gain when the gain switching input (GAIN) is open. • 2nd gain when the gain switching input (GAIN) is connected to COM–. ※If no input signal is allocated to the gain switching input (GAIN),the 1st gain is fixed.
3	Torque command	• Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis) (%) previously with the 1st gain. • Return to the 1st gain when the absolute value of the torque command was kept below (level - hysteresis) (%) previously during delay time with the 2nd gain.
4	Speed command variation is large	• Valid only during velocity control. • Shift to the 2nd gain when the absolute value of the speed command variations exceeded (level + hysteresis) (10 r/min/s) previously with the 1st gain. • Return to the 1st gain when the absolute value of the speed command variations was kept below (level - hysteresis) (10 r/min/s) during delay time previously with the 2nd gain. ※ The 1st gain is fixed while the velocity control is not applied.
5	Speed command is large	• Valid for velocity controls. • Shift to the 2nd gain when the absolute value of the speed command exceeded (level + hysteresis) (r/min) previously with the 1st gain. • Return to the 1st gain when the absolute value of the speed command was kept below (level - hysteresis) (r/min) previously during delay time with the 2nd gain.

Related pages:
For the switching level and timing, refer to"Setup of Gain Switching Condition" of Adjustment

<table>
<tr><td rowspan="2">No.
Pr1.21</td><td>Name</td><td colspan="3">Delay time of velocity control switching</td><td>Setting enabled</td><td>Immediately enabled</td><td>Data range</td><td>0-10000</td></tr>
<tr><td>Accessibility</td><td>RW</td><td>Unit</td><td>0.1ms</td><td>Correlation model</td><td>S</td><td>Factory default</td><td>0</td></tr>
</table>

For velocity controlling: When shifting from the 2nd gain to the 1st gain with Pr1.20 Velocity control switching mode set at 3, 4 or 5, set the delay time from trigger detection to the switching operation.

<table>
<tr><td rowspan="2">No.
Pr1.22</td><td>Name</td><td colspan="3">Level of velocity control switching</td><td>Setting enabled</td><td>Immediately enabled</td><td>Data range</td><td>0-20000</td></tr>
<tr><td>Accessibility</td><td>RW</td><td>Unit</td><td>-</td><td>Correlation model</td><td>S</td><td>Factory default</td><td>0</td></tr>
</table>

For velocity controlling: Set up triggering level when Pr1.20 Velocity control gain switching mode is set at 3, 4 or 5.
Note:
Unit of setting varies with switching mode.
Set the level equal to or higher than the hysteresis.

<table>
<tr><td rowspan="2">No.
Pr1.23</td><td>Name</td><td colspan="3">Hysteresis at velocity control switching</td><td>Setting enabled</td><td>Immediately enabled</td><td>Data range</td><td>0-20000</td></tr>
<tr><td>Accessibility</td><td>RW</td><td>Unit</td><td>-</td><td>Correlation model</td><td>S</td><td>Factory default</td><td>0</td></tr>
</table>

For velocity controlling: Set up triggering hysteresis when Pr1.20 Velocity control gain switching mode is set at 3, 4 or 5. Note: Unit of setting varies with switching mode. When level < hysteresis, the hysteresis is internally adjusted so that it is equal to level.

No. Pr1.24	Name	Mode of torque control switching			Setting enabled	Immediately enabled	Data range	0-3
	Accessibility	RW	Unit	-	Correlation model	T	Factory default	0

For torque controlling: Set the condition to trigger gain switching.

Set value	Switching conditions	Gain switching condition
[0]	Fixed to the 1st gain	Fixed to the 1st gain (Pr1.00 - Pr1.04).
1	Fixed to the 2nd gain	Fixed to the 2nd gain (Pr1.05 - Pr1.09).
2	Gain switching input	• 1st gain when the gain switching input (GAIN) is open. • 2nd gain when the gain switching input (GAIN) is connected to COM–. ※ If no input signal is allocated to the gain switching input (GAIN), the 1st gain is fixed.
3	Torque command	• Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis) (%) previously with the 1st gain. • Return to the 1st gain when the absolute value of the torque command was kept below (level - hysteresis) (%) previously during delay time with the 2nd gain.

No. Pr1.25	Name	Delay time of torque control switching			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	ms	Correlation model	T	Factory default	0

For torque controlling : When shifting from the 2nd gain to the 1st gain with Pr1.24 Torque control switching mode set at 3, set up the delay time from trigger detection to the switching operation.

No. Pr1.26	Name	Level of torque control switching			Setting enabled	Immediately enabled	Data range	0-20000
	Accessibility	RW	Unit	ms	Correlation model	T	Factory default	0

For torque controlling: Set up triggering level when Pr1.24 Torque control gain switching mode is set at 3.
Unit varies depending on the setup of mode of control switching.
Note:
Set the level equal to or higher than the hysteresis

No. Pr1.27	Name	Hysteresis at torque control switching			Setting enabled	Immediately enabled	Data range	0-20000
	Accessibility	RW	Unit	-	Correlation model	T	Factory default	0

For torque controlling: Set up triggering hysteresis when Pr1.24 Torque control gain switching mode is set at 3.
Unit of setting varies with switching mode.
Note:
When level < hysteresis, the hysteresis is internally adjusted so that it is equal to level.

4.3.3 Group Pr02 parameters

No. Pr2.00	Name	Adaptive filter mode setup			Setting enabled	Immediately enabled	Data range	0-6
	Accessibility	RW	Unit	-	Correlation model	P/S	Factory default	1

Set up the resonance frequency to be estimated by the adaptive filter and specify the operation after estimation.

Set value	Content	
0	Adaptive filter:invalid	Parameters related to the 3rd and 4th notch filter hold the current value.
1	Adaptive filter:1 filter is valid	One adaptive filter is enabled. Parameters related to the 3rd notch filter will be updated based on adaptive performance.
2	Adaptive filter:2 filters are valid	Two adaptive filters are enabled. Parameters related to the 3rd and 4th notch filters will be updated based on adaptive performance.
3	Resonance frequency measurement mode	Measure the resonance frequency. Result of measurement can be checked with Ω Master. Parameters related to the 3rd and 4th notch filter hold the current value
4	Clear result of adaptation	Parameters related to the 3rd and 4th notch filter are disabled and results of adaptive operation are cleared.
5	For manufacturer's use	Reserved
6	For manufacturer's use	Reserved

No. Pr2.01	Name	1st notch frequency			Setting enabled	Immediately enabled	Data range	50-5000
	Accessibility	RW	Unit	Hz	Correlation model	ALL	Factory default	5000

Set the center frequency of the 1st notch filter.
Note: The notch filter function will be invalidated by setting up this parameter to "5000".

No. Pr2.02	Name	1st notch width selection			Setting enabled	Immediately enabled	Data range	0-20
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	2

Set the width of notch at the center frequency of the 1st notch filter.
Note: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

No. Pr2.03	Name	1st notch depth selection			Setting enabled	Immediately enabled	Data range	0-99
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set the depth of notch at the center frequency of the 1st notch filter.
Note: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

No. Pr2.04	Name	2nd notch frequency			Setting enabled	Immediately enabled	Data range	50-5000
	Accessibility	RW	Unit	Hz	Correlation model	ALL	Factory default	5000

Set the center frequency of the 2nd notch filter.
Note:The notch filter function will be invalidated by setting up this parameter to "5000".

No. Pr2.05	Name	2nd notch width selection			Setting enabled	Immediately enabled	Data range	0-20
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	2

Set the width of notch at the center frequency of the 2nd notch filter.
Note: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

No. Pr2.06	Name	2nd notch depth selection	Setting enabled	Immediately enabled	Data range	0-99

	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set the depth of notch at the center frequency of the 2nd notch filter.
Note: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

No. Pr2.07	Name	3nd notch frequency			Setting enabled	Immediately enabled	Data range	50-5000
	Accessibility	RW	Unit	Hz	Correlation model	ALL	Factory default	5000

Notch frequency is automatically set to the 1st resonance frequency estimated by the adaptive filter.
Note: In no resonance point is found, the frequency is set to 5000.

No. Pr2.08	Name	3rd notch width selection			Setting enabled	Immediately enabled	Data range	0-20
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	2

Set the width of notch at the center frequency of the 3rd notch filter.
Note: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.
When the applicable filter function is used, parameter value is automatically set

No. Pr2.09	Name	3rd notch depth selection			Setting enabled	Immediately enabled	Data range	0-99
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set the depth of notch at the center frequency of the 3rd notch filter..
Note: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.
When the applicable filter function is used, parameter value is automatically set.

No. Pr2.10	Name	4th notch frequency			Setting enabled	Immediately enabled	Data range	50-5000
	Accessibility	RW	Unit	Hz	Correlation model	ALL	Factory default	5000

Notch frequency is automatically set to the 2nd resonance frequency estimated by the adaptive filter.
Note: The notch filter function will be invalidated by setting up this parameter to "5000".

No. Pr2.11	Name	4th notch width selection			Setting enabled	Immediately enabled	Data range	0-20
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	2

Set the width of notch at the center frequency of the 4th notch filter.
Note: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.
When the applicable filter function is used, parameter value is automatically set.

No. Pr2.12	Name	4th notch depth selection			Setting enabled	Immediately enabled	Data range	0-99
	Accessibility	RW	Unit		Correlation model	ALL	Factory default	0

Set the depth of notch at the center frequency of the 4th notch filter..
Note: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.
When the applicable filter function is used, parameter value is automatically set.

No. Pr2.13	Name	Selection of damping filter switching			Setting enabled	Immediately enabled	Data range	0-6
	Accessibility	RW	Unit	-	Correlation model	P/F	Factory default	0

Among 4 filters select the filters to be used for damping control.
When setup value is 0: the 1st and 2nd filters can be used simultaneously.
When setup value is 1 or 2: Select the filter with external input(s) (VS-SEL1 and/or VS-SEL2).

Set value	VS-SEL1	VS-SEL2	1st damping control	2nd damping control	3rd damping control	4th damping control
[0]	-	-	O	O		
1	-	OFF	O		O	
	-	ON		O		O
2	OFF	OFF	O			

	OFF	ON		O		
	ON	OFF			O	
	ON	ON				O

With setup value 3: Select the filter with command direction.

Set value	Position command direction	1st damping control	2nd damping control	3rd damping control	4th damping control
3	Positive direction	O		O	
	Negative direction		O		O

Contents of setup values 4 to 6 will differ with enabled/disabled switching of two degree-of freedom control mode.
Position control (Two degree-of-freedom control mode disabled).

Set value	VS-SEL1	1st damping control	2nd damping control	3rd damping control	4th damping control
4	-	O	O	O	
5, 6	Same as the case when the set value of 0, the 1st and 2nd damping control is valid				

Position control (Two degree-of-freedom control mode enabled).

Set value	VS-SEL1	1st damping control	2nd damping control
4	-	O	O
5	OFF	O	
	ON		O

Set value	Position command direction	1st damping control	2nd damping control
6	Positive direction	O	
	Negative direction		O

full-close control

Set value	1st damping control	2nd damping control	3rd damping control	4th damping control
4-6	O	O		

Note: Switching of damping controls will be done on the rising edge of the command whose number of pulses/0.125 ms has been changed from 0 while the positioning complete signal is being output.

When the damping frequency frequency is high or changing to disable, and positioning complete range is large, pulses are stored in the filter at that time. Note that since these pulses will be discharged at a higher rate upon switching to return back to the homeal position, the motor may run at a speed higher than the command speed for a short time.

No. Pr2.14	Name	1st damping frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P/F	Factory default	0

Set up the 1st damping frequency of the damping control which suppress vibration at the load edge.Setup unit is 0.1[Hz].
The setup frequency is 1.0 to 300.0[Hz].
Please refer to [Mechanical end jitter suppression] as well before using this parameter.

No. Pr2.15	Name	1st damping coefficient			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	0.001	Correlation model	P/F	Factory default	0

Set up the 1st damping coefficient of the damping control which suppress vibration at the load edge.Setup unit is 0.001.
The effective range of the damping coefficient is 0.001 - 1. The larger the damping ratio is, the stronger the action is.
Please refer to [Mechanical end jitter suppression] as well before using this parameter.

No. Pr2.16	Name	2nd damping frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P/F	Factory default	0

Set up the 2nd damping frequency of the damping control which suppress vibration at the load edge.Setup unit is 0.1[Hz].
The setup frequency is 1.0 to 300.0[Hz].
Please refer to [Mechanical end jitter suppression] as well before using this parameter.

No. Pr2.17	Name	2nd damping coefficient			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	0.001	Correlation model	P/F	Factory default	0

Set up the 2nd damping coefficient of the damping control which suppress vibration at the load edge.Setup unit is 0.001.
The effective range of the damping coefficient is 0.001 - 1. The larger the damping ratio is, the stronger the action is.
Please refer to [Mechanical end jitter suppression] as well before using this parameter.

No. Pr2.18	Name	3rd damping frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P/F	Factory default	0

Set up the 3rd damping frequency of the damping control which suppress vibration at the load edge.Setup unit is 0.1[Hz].
The setup frequency is 1.0 to 300.0[Hz].
Please refer to [Mechanical end jitter suppression] as well before using this parameter.

No. Pr2.19	Name	3rd damping coefficient			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	0.001	Correlation model	P/F	Factory default	0

Set up the 3rdt damping coefficient of the damping control which suppress vibration at the load edge.Setup unit is 0.001.
The effective range of the damping coefficient is 0.001 - 1. The larger the damping ratio is, the stronger the action is.
Please refer to [Mechanical end jitter suppression] as well before using this parameter.

No. Pr2.20	Name	4th damping frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P/F	Factory default	0

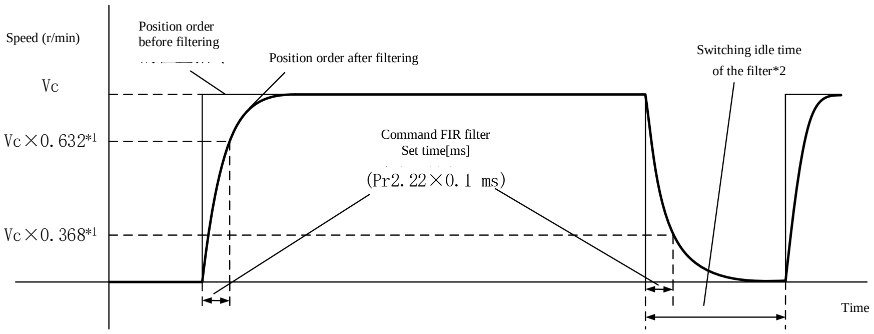
Set up the 4th damping frequency of the damping control which suppress vibration at the load edge.Setup unit is 0.1[Hz].
The setup frequency is 1.0 to 300.0[Hz].
Please refer to [Mechanical end jitter suppression] as well before using this parameter.

No. Pr2.21	Name	4th damping coefficient			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	0.001	Correlation model	P/F	Factory default	0

Set up the 4th damping coefficient of the damping control which suppress vibration at the load edge.Setup unit is 0.001.
The effective range of the damping coefficient is 0.001 - 1. The larger the damping ratio is, the stronger the action is.
Please refer to [Mechanical end jitter suppression] as well before using this parameter.

No. Pr2.22	Name	Command smoothing filter			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	0.1ms	Correlation model	P/F	Factory default	92

[Position control mode]
Set the time constant of the 1st delay filter in response to the positional command.
1. Actual filter time constant (setup value ×0.1 ms) has the maximum absolute error of 0.4 ms for a time constant below 100 ms and the maximum relative error of 0.2 % for a time constant 20 ms or more.

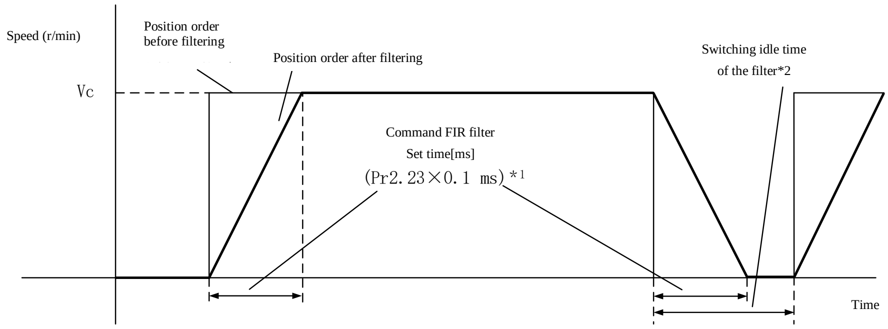


2. Switching of Pr2.22 Positional command smoothing filter is performed on the rising edge of the command with the number of command pulses/0.1 ms is changed from 0 to a value other than 0 while the positioning complete is being output.
When the filter time constant is small and positioning complete range is large, the cumulative pulse remains in the filter at the above time (the value of the position command before filtering subtracted by the position command after filtering, the area is obtained by

time integration) and the motor will quickly return to the homeal position after switching, so the motor speed may be higher than the previous command speed.
3. Even if Pr2.22 Positional command smoothing filter is changed, it is not applied immediately. If the switching as described in *2 occurs during this delay time, the change of Pr2.22 will be suspended.

No. Pr2.23	Name	Command FIR filter			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	0.1ms	Correlation model	P/F	Factory default	10

[Position control mode]
Set up the time constant of FIR filter in response to the command.
[Speed control mode]
In the two-degree-of-freedom control mode (Pr6.47 bit0 = 1).Time constant of the command response filter.
When a square wave command for the target speed Vc is applied, set up the time constant of the 1st delay filter as shown in the figure below.



1. The actual average travel time (setup value ×0.1 ms) has the maximum absolute error of 0.2 ms for a time constant below 10 ms and the maximum relative error of 1.6 % for a time constant 10 ms or more.
2 When changing Pr2.23 Command FIR filter, stop the command pulse and wait until the filter switching wait time has elapsed. The filter switching wait time is the setup value ×0.1 ms + 0.25 ms when the setup time is 10 ms, and setup value ×0.1 ms ×1.05 when the setup time is 10 ms or more. If Pr2.23 is changed while the command pulse is being input, the change is not reflected until the command pulseless state has continued for the filter switching wait time.
3 Even if Pr2.23 Command FIR filter is changed, it is not applied immediately. If the switching as described in *2 occurs during this delay time, the change of Pr2.23 will be suspended.

No. Pr2.24	Name	5th notch frequency			Setting enabled	Immediately enabled	Data range	50-5000
	Accessibility	RW	Unit	Hz-	Correlation model	ALL	Factory default	5000

Set the center frequency of the 5th notch filter.
Note: The notch filter function will be invalidated by setting up this parameter to "5000".

No. Pr2.25	Name	5th notch width selection			Setting enabled	Immediately enabled	Data range	0-20
	Accessibility	RW	Unit	Hz-	Correlation model	ALL	Factory default	2

Set the width of notch at the center frequency of the 5th notch filter.
Note:Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

No. Pr2.26	Name	5th notch depth selection			Setting enabled	Immediately enabled	Data range	0-99
	Accessibility	RW	Unit	db	Correlation model	ALL	Factory default	0

Set the depth of notch at the center frequency of the 5th notch filter.
Note: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

No. Pr2.27	Name	1st vibrationcontrol width setting			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	-	Correlation model	P/F	Factory default	0

To conduct fine tuning of 1st vibration suppression control function.

No. Pr2.28	Name	2nd vibrationcontrol width setting			Setting enabled	Immediately enabled	Data range	0-1000

	Accessibility	RW	Unit	-	Correlation model	P/F	Factory default	0
To conduct fine tuning of 2nd vibration suppression control function.								

No. Pr2.29	Name	3rd vibrationcontrol width setting		Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	-	Correlation model	P/F	Factory default	0
To conduct fine tuning of 3rd vibration suppression control function.								

No. Pr2.30	Name	4th vibrationcontrol width setting		Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	-	Correlation model	P/F	Factory default	0
To conduct fine tuning of 4th vibration suppression control function.								

4.3.4 Group Pr03 parameters

No. Pr3.00	Name	Speed setup, Internal/External switching		Setting enabled	Immediately enabled	Data range	0-3
	Accessibility	RW	Unit	-	Correlation model	S	Factory default	1

This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.

Set value	Speed setting method
[0]	Analog speed command (SPR)
1	Internal speed command 1st to 4th speed (Pr3.04 to Pr3.07)
2	Internal speed command 1st to 3rd speed (Pr3.04 to Pr3.06).Analog speed command (SPR)
3	Internal speed command 1st to 8th speed (Pr3.04 to Pr3.11)

<Relationship between Pr3.00 Internal/external switching speed setup and the internal command speed selection 1, 2 and 3, and speed command to be selected>

Set value	Selection 1 of internal command speed (INTSPD1)	Selection 2 of internal command speed (INTSPD2)	Selection 3 of internal command speed (INTSPD3)	Selection of Speed command
1	OFF	OFF	No effect	Speed 1
	ON	OFF		Speed 2
	OFF	ON		Speed 3
	ON	ON		Speed 4
2	OFF	OFF	No effect	Speed 1
	ON	OFF		Speed 2
	OFF	ON		Speed 3
	ON	ON		Analog speed command
3	The same as Pr3.00=1		OFF	Speed 1 -4
	OFF	OFF	ON	Speed 5
	ON	OFF	ON	Speed 6
	OFF	ON	ON	Speed 7
	ON	ON	ON	Speed 8

No. Pr3.01	Name	Speed command rotational direction selection		Setting enabled	Immediately enabled	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	S	Factory default	0

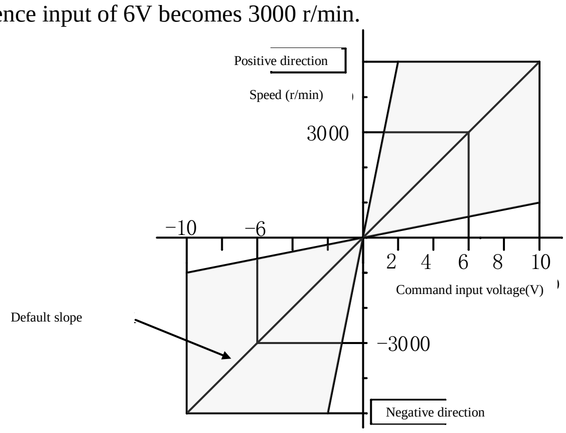
Select the Positive/Negative direction specifying method.

Set value	Select speed command (Speed 1 - 8)	Speed command symbol selection (VC-SIGN)	Speed command direction
0	+	No effect	Positive direction
	-	No effect	Negative direction
1	No effect on symbol	OFF	Positive direction
	No effect on symbol	ON	Negative direction

No. Pr3.02	Name	Input gain of speed command			Setting enabled	Immediately enabled	Data range	10-2000
	Accessibility	RW	Unit	rpm/V	Correlation model	S	Factory default	500

Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.

You can set up a "slope" of the relation between the command input voltage and the motor speed, with Pr3.02.
Default is set to Pr3.02=500 [r/min],hence input of 6V becomes 3000 r/min.



Note:

1. Do not apply more than ±10 V to the speed command input (SPR).
2. When you compose a position loop outside of the driver while you use the driver in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.Pay an extra attention to oscillation caused by larger setup of Pr3.02..

No. Pr3.03	Name	Reversal of speed command input			Setting enabled	Immediately enabled	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	S	Factory default	1

Specify the polarity of the voltage applied to the analog speed command (SPR)..

Set value	Motor rotation direction	
0	Non-reverse	"Positive voltage" → "Positive direction", "Negative voltage" → "Negative direction"
1	Reverse rotation	"Positive voltage" → "Negative direction", "Negative voltage" → "Positive direction"

Note:
When you compose the servo drive system with this driver set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup does not match.

No. Pr3.04	Name	1st speed of speed setup			Setting enabled	Immediately enabled	Data range	-20000 - 20000
	Accessibility	RW	Unit	rpm	Correlation model	S	Factory default	0

No. Pr3.05	Name	2nd speed of speed setup			Setting enabled	Immediately enabled	Data range	-20000 - 20000
	Accessibility	RW	Unit	rpm	Correlation model	S	Factory default	0

No. Pr3.06	Name	3rd speed of speed setup			Setting enabled	Immediately enabled	Data range	-20000 - 20000
	Accessibility	RW	Unit	rpm	Correlation model	S	Factory default	0

No. Pr3.07	Name	4th speed of speed setup			Setting enabled	Immediately enabled	Data range	-20000 - 20000
	Accessibility	RW	Unit	rpm	Correlation model	S	Factory default	0

No. Pr3.08	Name	5th speed of speed setup			Setting enabled	Immediately enabled	Data range	-20000 - 20000
	Accessibility	RW	Unit	rpm	Correlation model	S	Factory default	0

No. Pr3.09	Name	6th speed of speed setup			Setting enabled	Immediately enabled	Data range	-20000 - 20000
	Accessibility	RW	Unit	rpm	Correlation model	S	Factory default	0

No. Pr3.10	Name	7th speed of speed setup			Setting enabled	Immediately enabled	Data range	-20000 - 20000
	Accessibility	RW	Unit	rpm	Correlation model	S	Factory default	0

No. Pr3.11	Name	8th speed of speed setup			Setting enabled	Immediately enabled	Data range	-20000 - 20000
	Accessibility	RW	Unit	rpm	Correlation model	S	Factory default	0

Set up internal command speeds, 1st to 8th.

No. Pr3.12	Name	Acceleration time setup			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	ms/ krpm	Correlation model	S	Factory default	0

No. Pr3.13	Name	Deceleration time setup			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	ms/ krpm	Correlation model	S	Factory default	0

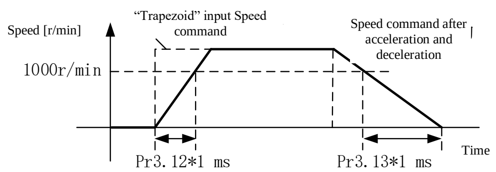
Set up acceleration/deceleration processing time in response to the speed command input.

Set the time required for the speed command (stepwise input) to reach 1000 r/min to Pr3.12 Acceleration time setup. Also set the time required for the speed command to reach from 1000 r/min to 0 r/min, to Pr3.13 Deceleration time setup.

Assuming that the target value of the speed command is Vc(r/min), the time required for acceleration/deceleration can be computed from the formula shown below.

Acceleration time (ms) = Vc/1000 × Pr3.12 × 1 ms

Deceleration time (ms) = Vc/1000 × Pr3.13 × 1 ms



Notice:

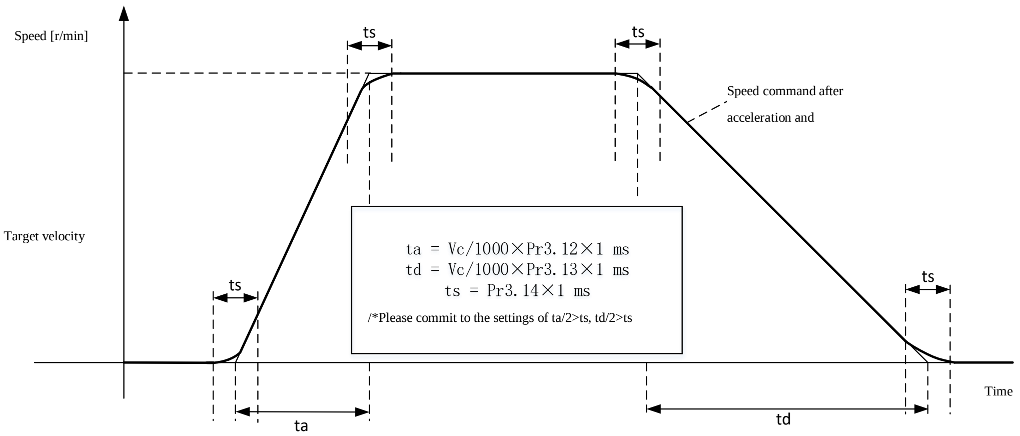
When the speed difference between the speed command being selected and the speed command after acceleration/deceleration

indicates the same direction as that of the speed command applied after acceleration/deceleration, result is “acceleration” and if the reverse direction, the result is “deceleration”.

No. Pr3.14	Name	Sigmoid acceleration/ deceleration time setup			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	ms	Correlation model	S	Factory default	0

Set S-curve time for acceleration/deceleration process when the speed command is applied.

According to Pr3.12 Acceleration time setup and Pr3.13 Deceleration time setup, set up sigmoid time with time width centering the inflection point of acceleration/deceleration.



No. Pr3.15	Name	Speed zero-clamp function selection			Setting enabled	Immediately enabled	Data range	0-2
	Accessibility	RW	Unit	-	Correlation model	S/T	Factory default	0

You can set up the function of the speed zero clamp input.

Set value	ZEROSPD input (26pin) function
[0]	Invalid: Speed zero-clamp input is ignored.
1	Speed command is forced to 0 when the speed zero clamp (ZEROSPD) input signal is turned ON.
2	Speed command is forced to 0 when the speed zero clamp (ZEROSPD) input signal is turned ON. And when the actual motor speed drops to Pr3.16 Speed zero clamp level or below, the position control is selected and servo lock is activated at this point. The fundamental operations except for this function (switching to the position control) are identical to those when setup value is 1.

Note: The default logic is b-contact: the function is enabled while the terminal is open (input signal is ON). Refer to P.3-40"Control input".

No. Pr3.16	Name	Speed zero clamp level			Setting enabled	Immediately enabled	Data range	10-20000
	Accessibility	RW	Unit	rpm	Correlation model	S/T	Factory default	30

Select the timing at which the position control is activated as the Pr3.15 Speed zero-clamp function selection is set to 2.

No. Pr3.17	Name	Selection of torque commande			Setting enabled	Immediately enabled	Data range	0-2
	Accessibility	RW	Unit	-	Correlation model	T	Factory default	0

You can select the input of the torque command and the speed limit.

Set value	Torque command input	Speed limit input
[0]	Analog input 1 * 1 (AI1, resolution 12 bit)	Parameter value (Pr3.21)
1	Analog input 2 (AI2, resolution 12bit)	Analog input 1 (AI1, resolution 12bit)

2	Analog input 1 * 1 (AI1, resolution 12 bit)	Parameter value (Pr3.21, Pr3.22)

For Pr0.01 Control mode setup = 5 (velocity/torque control), the torque command input is the analog input 2 (AI2, 12-bit resolution).

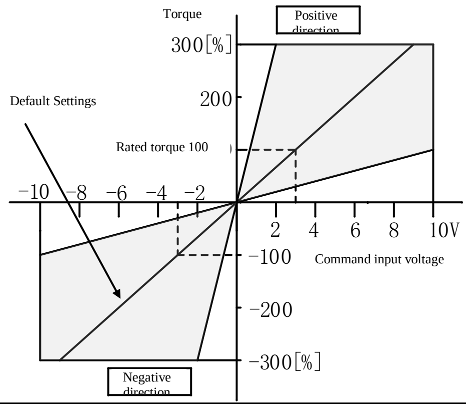
No.	Name	Torque command direction selection			Setting enabled	Immediately enabled	Data range	0-1
Pr3.18	Accessibility	RW	Unit	-	Correlation model	T	Factory default	0

Select the direction positive/negative direction of torque command.

Set value	Designation
[0]	Specify the direction with the sign of torque command. Example: Torque command input (+) for positive direction, (–) for negative direction
1	Specify the direction with torque command sign (TC-SIGN). OFF: Positive direction, ON: Negative direction

No.	Name	Input gain of torque command			Setting enabled	Immediately enabled	Data range	10-100
Pr3.19	Accessibility	RW	Unit	0.1V/100%	Correlation model	T	Factory default	30

Based on the voltage (V) applied to the analog torque command (TRQR), set up the conversion gain to torque command (%)..
• .Unit of the setup value is [0.1 V/100 %] and set up input voltage necessary to produce the rated torque.
• Default setup of 30 represents 3 V/100 %.



No.	Name	Input reversal of torque command			Setting enabled	Immediately enabled	Data range	0-1
Pr3.20	Accessibility	RW	Unit	-	Correlation model	T	Factory default	0

Set up the polarity of the voltage applied to the analog torque command (TRQR)..

Set value	Direction of motor torque	
0	Non-reverse	"Positive voltage" → "Positive direction", "Negative voltage" → "Negative direction"
1	Reverse rotation	"Positive voltage" → "Negative direction", "Negative voltage" → "Positive direction"

No.	Name	Speed limit value 1			Setting enabled	Immediately enabled	Data range	0-20000
Pr3.21	Accessibility	RW	Unit	rpm	Correlation model	T	Factory default	0

Set up the speed limit used for torque controlling.
During the torque controlling, the speed set by the speed limit value cannot be exceeded.
When Pr3.17 = 2, the speed limit is applied upon receiving positive direction command.

No.	Name	Speed limit value 2			Setting enabled	Immediately enabled	Data range	0-20000
Pr3.22	Accessibility	RW	Unit	rpm	Correlation model	T	Factory default	0

Speed limit value of negative direction command when Pr3.17 = 2.

Pr3.17	Pr3.21	Pr3.22	Pr3.15	Speed zero clamp(ZEROSPD)	Analog torque Command direction	Speed limit value
0	0-20000	No effect	0	No effect	No effect	Set value of Pr3.21
			1-2	OFF		Set value of Pr3.21
				ON		0
2	0-20000	0-20000	0	No effect	Positive direction	Set value of Pr3.21
					Negative direction	Set value of Pr3.22
	0-20000	0-20000	1-2	OFF	Positive direction	Set value of Pr3.21
					Negative direction	Set value of Pr3.22
	0-20000	0-20000	1-2	ON	No effect	0

No. Pr3.23*	Name	External scale selection			Setting enabled	Re-electrifying	Data range	0
	Accessibility	RW	Unit	-	Correlation model	F	Factory default	0

Select the type of external scale. OnlySupport AB phase output type external scale.

No. Pr3.24*	Name	Numerator of external scale division			Setting enabled	Re-electrifying	Data range	0-16777216
	Accessibility	RW	Unit	-	Correlation model	F	Factory default	0

Set up the numerator of the external scale dividing setup.
When setup value = 0, encoder resolution is used as numerator of the division.

No. Pr3.25*	Name	Denominator of external scale division			Setting enabled	Re-electrifying	Data range	1-16777216
	Accessibility	RW	Unit	-	Correlation model	F	Factory default	10000

- Check the number of encoder feedback pluses per one motor revolution and the number of external scale pulses per one motor revolution, and then set up the numerator of external scale division (Pr3.24) and the denominator of external scale division (Pr3.25) to establish the expression shown below.
- With Pr3.24 set at 0, the encoder resolution is automatically used as numerator.

Example: When ball screw pitch is 10 mm, scale 0.1 μm/pulse, encoder resolution 23 bits

$$\frac{Pr3.24}{Pr3.25}=\frac{8388608}{10000}=\frac{\text{Encoder resolution per circle of motor rotation [pulse]}}{\text{External displacement sensor resolution per circle of motor rotation [pulse]}}$$

Note: If this ratio is wrong, the difference between the position calculated based on the encoder pulses and the position calculated based on the external scale pulses becomes large over a long travel distance and will activate the excess hybrid deviation error protection.

No.	Name	Reversal of direction of external scale			Setting enabled	Re-electrifying	Data range	0-1
Pr3.26*	Accessibility	RW	Unit	-	Correlation model	F	Factory default	0

Reverse the direction of external scale, feedback counter.

Set value	Content
0	Count value of external scale can be used as it is.
1	Sign (positive/negative) of count value of external scale should be inverted.

No.	Name	External scale Z phase disconnection detection disable			Setting enabled	Re-electrifying	Data range	0-1
Pr3.27*	Accessibility	RW	Unit	-	Correlation model	F	Factory default	0

Enable/disable Z-phase disconnection detection when A, B phase output type external scale is used.

Set value	Content
0	Valid
1	Invalid

No.	Name	Hybrid deviation excess setup			Setting enabled	Re-electrifying	Data range	1-134217728
Pr3.28*	Accessibility	RW	Unit	Command unit	Correlation model	F	Factory default	16000

You can setup the permissible gap (hybrid deviation) between the present motor position and the present external scale position.

No.	Name	Hybrid deviation clear setup			Setting enabled	Re-electrifying	Data range	0-100
Pr3.29*	Accessibility	RW	Unit	Circle	Correlation model	F	Factory default	0

Clear the ybrid deviation when the number of motor rotation circles reaches the set value. Hybrid deviation is not cleared when the set value is 0.
This function allows the motor to be used in an application where hybrid deviation accumulate due to slippage, etc.
Note:
To use the hybrid deviation clear, be sure to set Pr3.29 Hybrid deviation clear setup to the appropriate value. If the setup value is too small with respect to the value of Pr3.28 Hybrid deviation excess setup, abnormal operation due to e.g. external scale connection error cannot be protected.
Limit sensor should be used to assure safety.

4.3.5 Group Pr04 parameters

No.	Name	SI1 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
Pr4.00*	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00828282h (8553090)

Set function assignment for SI1 input.
This parameter is set by using hexadecimal representation standard. * 5
After using hexadecimal representation, set the control modes as follows.
00————＊＊h: position/full-closed loop control
00——＊＊——h: speed control
00＊＊————h: torque control
Set the function number in "＊＊". Please refer to the following table for function number. The logic setting is also included in the function number.

Signal name	Signs	Function symbol	
		NO	NC
Invalid	-	00h	Non-configurable

Positive drive inhibiting input	POT	01h	81h
Negative drive inhibiting input	NOT	02h	82h
Servo enabling input＊1	SRV-ON	03h	83h
Alarm clearing	A-CLR	04h	Non-configurable
Control mode switching input＊2	C-MODE	05h	85h
Gain switching input	GAIN	06h	86h
Deviation counter clear input＊3	CL	07h	Non-configurable
Command pulse inhibiting input＊4	INH	08h	88h
Torque limit switching input	TL-SEL	09h	89h
Vibration control switching input 1	VS-SEL1	0Ah	8Ah
Vibration control switching input 2	VS-SEL2	0Bh	8Bh
Command frequency division and multiplication switching input 1	DIV1	0Ch	8Ch
Command frequency division and multiplication switching input 2	DIV2	0Dh	8Dh
Internal command speed selection 1 input	INTSPD1	0Eh	8Eh
Internal command speed selection 2 input	INTSPD2	0Fh	8Fh
Internal command speed selection 3 input	INTSPD3	10h	90h
Zero-speed clamp input	ZEROSPD	11h	91h
Speed command symbol input	VC-SIGN	12h	92h
Torque command symbol input	TC-SIGN	13h	93h
Forced alarm input	E-STOP	14h	94h
Inertia ratio switching input	J-SEL	15h	95h

TIPS Note:

1. Do not set the function model not listed in the table.
2. Multiple signals cannot be assigned to the same function. Otherwise, Err33.0"I/F repeated input assignment exception 1" and Err33.1"I/F repeated input assignment exception 2 " will occur.
3. Note that the front panel displays decimal.
4. Be sure to assign the servo connection input signal (SRV-ON). If not, the servo cannot be started.
5. When switching the input (C-MODE) in the control mode, it is necessary to set in all modes. If only one or two control modes are set, Err33.2"I/F input function model exception 1" or Err33.3"I/F input function model exception 2" will occur.
6. Control input pins with invalid settings do not affect action.
7. Functions used in multiple control modes (servo connection input and alarm clear function) must be assigned to the same pin and combined with logic. If not set correctly, Err33.0"I/F repeated input assignment exception 1", Err33.1"I/F repeated input assignment exception 2", Err33.2"I/F input function model exception 1" and Err33.3"I/F input function model exception 2" will occur.
8. The deviation counter clear input (CL) can only be assigned to SI7 input. If it is assigned in other positions, Err33.6"Counter clear assignment exception" will occur.

No. Pr4.01*	Name	SI2 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00818181h (8487297)

No. Pr4.02*	Name	SI3 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0091910Ah (9539850)

No. Pr4.03*	Name	SI4 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00060606h (394758)

No. Pr4.04*	Name	SI5 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0000100Ch (4108)

No. Pr4.05*	Name	SI6 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00030303h (197379)

No. Pr4.06*	Name	SI7 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00000f07h (3847)

Note: "Deviation counter clear (CL)" is only possible when this parameter is set. When setting other parameters, Err33.6"Counter clear assignment exception" will occur.

No. Pr4.07*	Name	SI8 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00040404h (263172)

No. Pr4.08*	Name	SI9 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00050505h (328965)

No. Pr4.09*	Name	SI10 input selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00000E88h (3720)

Set the input function assignment of SI2 - 10.
This parameter is set with hexadecimal representation standard.
The setting method is the same as that for Pr4.00.
Note: Refer to P.3-40"Control input" for the assignment of the input pins as standard factory default.

TIPS Note:
"Command pulse inhibiting input (INH)" can only be set by using this parameter. If other parameters are used, "Command pulse inhibiting input assignment exception" will occur.

No. Pr4.10*	Name	SO1 output selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00030303h (197379)

Set function assignment for SO1 output.
This parameter is set by using hexadecimal representation standard. * [1]
After using hexadecimal representation, set the control modes as follows.

00 - - - - * * h: position/full-closed loop control

00 - - * * - - h: speed control

00 * * - - - - h: torque control

Set the function number in "＊＊". Please refer to the following table for function number

Function No.	Signal name	Signs
00h	Invalid	-
01h	Servo alarm output	ALM
02h	Servo ready output	S-RDY
03h	External brake release signal	BRK-OFF
04h	Positioning completion	INP
05h	Speed arrival output	AT-SPEED
06h	Signal output in torque limit	TLC
07h	Zero speed detection signal	ZSP
08h	Speed consistency output	V-COIN
09h	Warning output 1	WARN1
0Ah	Warning output 1	WARN2
0Bh	Position command output or not	P-CMD
0Ch	Positioning completion 2	INP2
0Dh	Output under speed limit	V-LIMIT
0Eh	Reserved	
0Fh	Speed command output or not	V-CMD
10h	Reserved	

Notice:
＜Change example＞
"00090909h" when the standard factory default changes from "External brake release signal"(full mode) to "Warning output 1".
Related pages: section 2.14.1
＜Change example＞
"00090909H" when the standard factory default changes from "External brake release signal"(full mode) to "Warning output 1"
.
※ Use the installation and debugging software "Ω Master"
for simple operation of above settings.

The output signal can assign the same function to a complex signal.
Set the invalid control output pin, to keep the output transistor OFF.
Do not set any set value other than the function number in the table above.

Note:
* 1. Note that the front panel displays decimal.

No. Pr4.11*	Name	SO2 output selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00020202h (131586)

No. Pr4.12*	Name	SO3 output selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00010101h (65793)

No. Pr4.13*	Name	SO4 output selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00050504h (328964)

No. Pr4.14*	Name	SO5 output selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00070707h (460551)

Set function assignment for SO2 - SO6 output.
This parameter is set by using hexadecimal representation standard.
The setting method is the same as that for Pr4.10.

No. Pr4.15*	Name	SO6 output selection			Setting enabled	Re-electrifying	Data range	0 - 00FFFFFFh
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	00060606h (394758)

Set function assignment for SO2 - SO6 output.
This parameter is set by using hexadecimal representation standard.

The setting method is the same as that for Pr4.10.

No. Pr4.16	Name	Type of analog monitor 1			Setting enabled	Immediately enabled	Data range	0-28
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Select the type of analog monitor 1. * Refer to the following table.

Pr4.16/Pr4.18	Monitor type	Unit	Pr4.17/Pr4.19=0 Output gain at setting
0	Motor speed	r/min	500
3	Speed control command	r/min	500
4	Torque command	%	33
5	Command position deviation	Pulse (command unit)	3000
6	Encoder position deviation	Pulse (encoder unit)	3000
9	Voltage between PN	V	80
12	Positive torque limit	%	33
13	Negative torque limit	%	33
14	Speed limit value	r/min	500
15	Ratio of inertias	%	500
16	Analog input 1	V	1
17	Analog input 2	V	1
23	Command input state	0: no command 1: command available	*6
24	Gain selection state	0: 1st gain under selection 1: 2nd and third gains under selection	*6
25	Positioning completion state	0: Positioning is not completed; 1: Positioning is completed	*6
26	Whether there is an alarm	0: No 1: Yes	*6

1. The rotation data of the encoder is not subject to Pr0.00"Rotation direction setting limit" and CCW is usually the positive direction data. The positive and negative direction of other monitoring data is set according to Pr0.00"Rotation direction setting" in principle.
2. Analog input 1 - 3 is unrelated to the use of analog input function, and the terminal voltage is output at any time.
3. The front of the command filter (smoothing filter, FIR filter) of the command pulse input display the position command speed, and the back of the filter display the internal command speed.

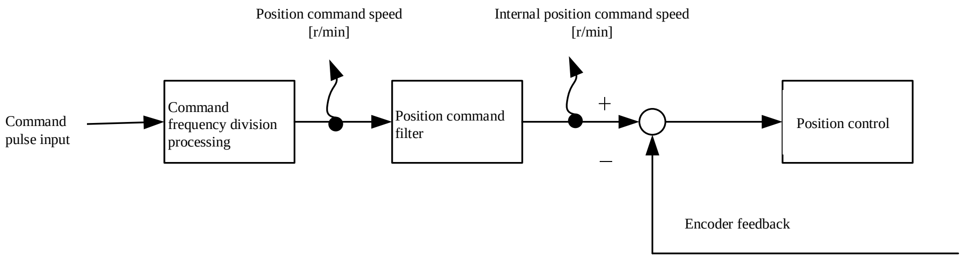


Fig. 4.2.5-1 Rotation direction setting

4. The position command deviation refers to the deviation of the command pulse input, and the deviation of the encoder position deviation controls the input part. The details are shown in the figure below.

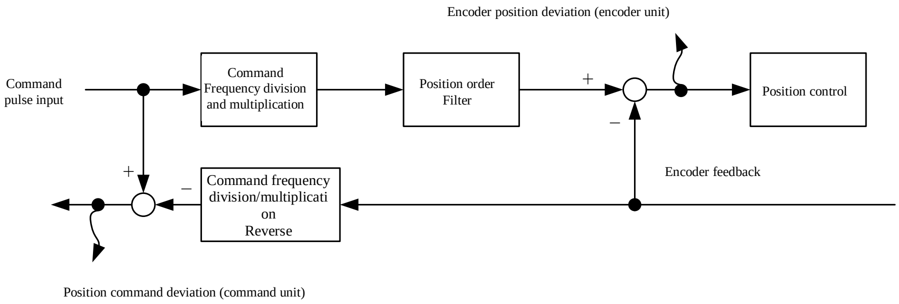


Fig. 4.2.5-2 Rotation direction setting

*5. Regardless of Pr4.17 and Pr4.19 setting, unit 0 is 0V output gain and unit 1 is 5V output gain

No. Pr4.17	Name	Output gain of analog monitor 1			Setting enabled	Immediately enabled	Data range	0 - 214748364
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1
Set the output gain of analog monitor 1. When PR4.16 =0 "Motor speed", the set value of motor speed [r/min]= PR4.17 is used for 1V output.								

No. Pr4.18	Name	Type of analog monitor 2			Setting enabled	Immediately enabled	Data range	0-28
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0
Select the type of analog monitor 2. Refer to the table for Pr4.16.								

No. Pr4.19	Name	Output gain of analog monitor 2			Setting enabled	Immediately enabled	Data range	0 - 214748364
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1
Set the output gain of analog monitor 2. When Pr4.18=4"Torque command", the set value of torque command [%] = Pr4.19 is used for 1V output.								

No. Pr4.21	Name	Analog monitor output setting			Setting enabled	Immediately enabled	Data range	0-2
	Accessibility	Manufacturer Use	Unit	-	Correlation model	ALL	Factory default	0
Select the output mode of the analog monitor.								

Set value	Output mode
[0]	Output -10V - 10V with symbol
1	Absolute value data output 0V - 10V
2	Output 0V - 10V(5V center) with drift data

No. Pr4.22	Name	Analog input 1 (AI1) zero drift setting			Setting enabled	Immediately enabled	Data range	-10000 - 10000
	Accessibility	RW	Unit	mV	Correlation model	ALL	Factory default	0
Set the drift adjustment value for the voltage applied to analog input 1.								

No. Pr4.23	Name	Analog input 1 (AI1) filter			Setting enabled	Immediately enabled	Data range	0-6400
	Accessibility	RW	Unit	ms	Correlation model	ALL	Factory default	0
Set the time constant of one filter delay for the voltage applied to analog input 1.								

No. Pr4.24	Name	Analog input 1 (AI1) overvoltage setting			Setting enabled	Immediately enabled	Data range	0-100
	Accessibility	RW	Unit	V	Correlation model	ALL	Factory default	0
Set the excessive class of the input voltage of analog input 1 by using the drifted voltage.								

No. Pr4.25	Name	Analog input 2 (AI2) zero drift setting			Setting enabled	Immediately enabled	Data range	-10000 - 10000
	Accessibility	RW	Unit	mV	Correlation model	ALL	Factory default	0
Set the drift adjustment value for the voltage applied to analog input 2.								

No. Pr4.26	Name	Analog input 2 (AI2) filter			Setting enabled	Immediately enabled	Data range	0-6400
	Accessibility	RW	Unit	ms	Correlation model	ALL	Factory default	0

Set the time constant of one filter delay for the voltage applied to analog input 2.

No. Pr4.27	Name	Analog input 2 (AI2) overvoltage setting			Setting enabled	Immediately enabled	Data range	0-100
	Accessibility	RW	Unit	V	Correlation model	ALL	Factory default	0

Set the excessive class of the input voltage of analog input 2 by using the drifted voltage.

No. Pr4. 28	Name	Analog input 3 (AI3) zero drift setting			Setting enabled	Immediately enabled	Data range	-10000 - 10000
	Accessibility	RW	Unit	mV	Correlation model	ALL	Factory default	0

Set the drift adjustment value for the voltage applied to analog input 3.

No. Pr4.29	Name	Analog input 3 (AI3) filter			Setting enabled	Immediately enabled	Data range	0-6400
	Accessibility	RW	Unit	ms	Correlation model	ALL	Factory default	0

Set the time constant of one filter delay for the voltage applied to analog input 3.

No. Pr4.30	Name	Analog input 2 (AI3) overvoltage setting			Setting enabled	Immediately enabled	Data range	0-100
	Accessibility	RW	Unit	V	Correlation model	ALL	Factory default	0

Set the excessive class of the input voltage of analog input 3 by using the drifted voltage.

No. Pr4.31	Name	Positioning completion range			Setting enabled	Immediately enabled	Data range	0-2097152
	Accessibility	RW	Unit	Command unit	Correlation model	P	Factory default	10

Set the position deviation range of positioning completion signal (INP1) output.

TIPS Note:

The set unit at the factory is the command unit, but it can be changed to the encoder unit by Pr5.20 "Position setting unit selection". However, in this case, the unit of Pr0.14"Excessive position deviation setting" also changes.

Notice:

Refer to "Pr5.20" for the instructions on "Command unit" and "Encoder unit".

No. Pr4.32	Name	Positioning completion output setting			Setting enabled	Immediately enabled	Data range	0-10
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Select the positioning completion signal (INP) output conditions

Set value	Action of positioning completion signal
[0]	Set to "ON" when the position deviation is below Pr4.31 (positioning completion range).
1, 6	Set to "ON" when there is no position command and the position deviation is below Pr4.31 (positioning completion range).
2, 7	Set to "ON" when there is no position command, the zero speed detection signal is "ON" and the position deviation is below Pr4.31 (Positioning completion range).
3, 8	Set to "ON" when there is no position command and the position deviation is below Pr4.31 (positioning completion range). After that, it is maintained "ON" until the end of Pr4.33"INP retention time". Set INP output to "ON"/"OFF" according to the position command and position deviation after INP retention time.
4, 9	After the positioning delay time set in Pr4.33 "INP retention time" has passed in case of "Position command available → NA", the positioning completion judgment will be started. Set to "ON" when there is no position command and the position deviation is below Pr4.31"Positioning completion range".
5, 10	After the positioning delay time set in Pr4.33 "INP retention time" has passed from positioning completion range in case of "Position command available → NA", the positioning completion judgment will be started. Set to "ON" when there is no position command or the position deviation is below Pr4.31"Positioning completion range".

Note:

For the presence or absence of position command, the set values 1 - 5 are judged by the command after the position command filtering, and set values 6 - 10 are judged by the command before the position command filtering.

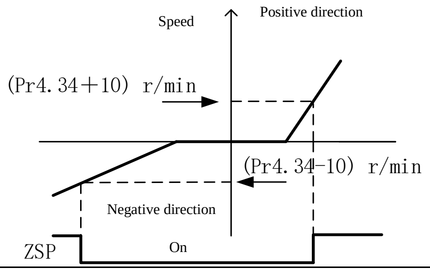
No. Pr4.33	Name	INP hold time			Setting enabled	Immediately enabled	Data range	0-30000
	Accessibility	RW	Unit	ms	Correlation model	P	Factory default	0

Set the retention time when Pr4.32"Positioning completion output setting"=3.

Set value	Action of positioning completion signal
[0]	Retain for an infinite time and remain "ON" until the next command is received.
1-30000	Only set the value [ms] to continue at the "ON" state. However, if the position command is received during the retention, it becomes "OFF" state.

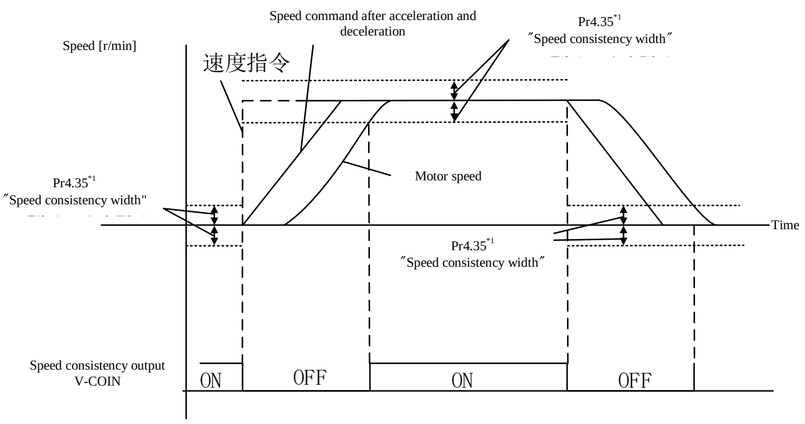
No. Pr4.34	Name	Zero speed			Setting enabled	Immediately enabled	Data range	10-20000
	Accessibility	RW	Unit	rpm	Correlation model	ALL	Factory default	50

Set the time to output zero speed detection signal (ZSP or TCL) through the rotation speed [r/min].
When the speed of the motor is lower than the set speed of this parameter Pr4.34, the zero speed detection signal (ZSP) is output.
The setting of Pr4.34 is unrelated to the motor rotation direction.
There is a hysteresis of 10[r/min] in the positive/negative directions .



No. Pr4.35	Name	Speed consistency width			Setting enabled	Immediately enabled	Data range	10-20000
	Accessibility	RW	Unit	rpm	Correlation model	S/T	Factory default	50

Set the detection time of speed consistency output (V-COIN).
Output the speed consistency output (V-COIN) if the difference between the speed command and the motor speed is below this set value.



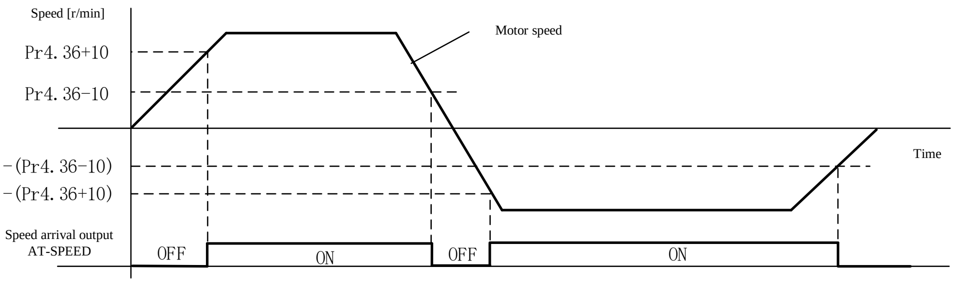
In order to maintain the hysteresis of 10 r/min, the actual detection width of speed consistency is shown as follows:

Time (Pr4.35 - 10)r/min for speed consistency output during OFF→ON

Time (Pr4.35 + 10)r/min during ON→OFF

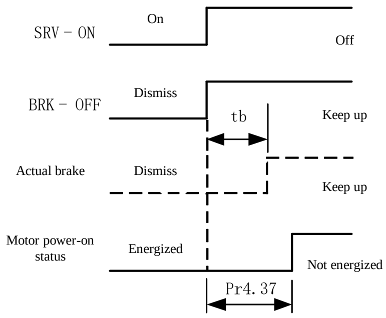
No. Pr4.36	Name	Arrival speed		Setting enabled	Immediately enabled	Data range	10-20000
	Accessibility	RW	Unit	rpm	Correlation model	S/T	Factory default	1000

Set the detection time of speed arrival output (AT-SPEED).
Output the speed arrival output (AT-SPEED) when the motor speed exceeds this set value.
10r/min hysteresis is detected.



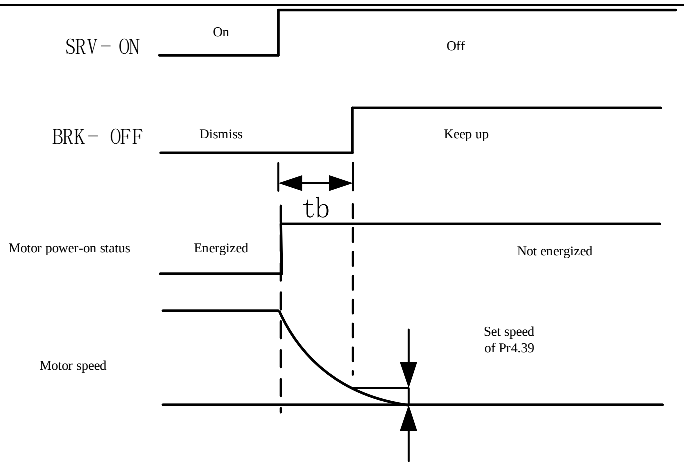
No. Pr4.37	Name	Mechanical brake action setting when stopped		Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	rpm	Correlation model	ALL	Factory default	0

When the servo enable is switched off while the motor is stopped, set the time from the brake release signal (BRK-OFF) is switched off (brake holding) to the motor not energized (servo free).
Set to prevent minor movement/fall of the motor (workpiece) due to the response delay (t_b) of the brake.
Set Pr4.37 $\geqq t_b$
In practice, after the brake action, it is set to the servo enable off state.
Note: This value is used to set the PWM OFF delay time after the motor stops; if the motor needs to stop freely, please set this value to 0.



No. Pr4.38	Name	Mechanical brake action setting during action		Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	ms	Correlation model	ALL	Factory default	0

When the servo enable is turned off while the motor is rotating, set the time from the detection of servo enable on input signal (SRV-ON) turned off to the external brake release signal (BRK-OFF) is turned off.
It is set to prevent brake deterioration due to motor rotation.
The servo enable off method in the motor rotation is as follows. The time tb in the figure below is the set time of Pr4.38 or the time when the motor rotation speed drops below the set speed of Pr4.39, whichever is smaller.



Note: This value is used to set the brake DO off delay time after the enable DI is disconnected; if the motor needs to stop freely, please set this value to 0;

No.	Name	Brake release speed setting			Setting enabled	Immediately enabled	Data range	30-3000
Pr4.39	Accessibility	RW	Unit	rpm	Correlation model	ALL	Factory default	30

Set the timing of the speed determined by the mechanical brake output during the action.

No.	Name	Warning output selection 1			Setting enabled	Immediately enabled	Data range	0-10
Pr4.40	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

No.	Name	Warning output selection 2			Setting enabled	Immediately enabled	Data range	0-10
Pr4.41	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Use warning output 1 and 2 to select the type of output warning .

Set value	Warning name	Content
[0]	—	"OR" output of all warnings
1	Overload warning	More than 85% of the load rate protection grade
2	Over-regeneration warning	More than 85% of the regenerative load rate grade

No.	Name	Positioning completion range 2			Setting enabled	Immediately enabled	Data range	0-2097152
Pr4.42	Accessibility	RW	Unit	Command unit	Correlation model	P	Factory default	10

Set the position deviation time of positioning completion signal 2 (INP2) output.
INP2 is not affected by Pr4.32"Positioning completion output setting" and is set to "ON" when the position deviation is kept below this set value. (Not judged according to the presence or absence of position command.)
Note: The set unit at the factory is the command unit, but it can be changed to the encoder unit by Pr5.20 "Position setting unit selection". In this case, the unit of Pr0.14"Excessive position deviation setting" also changes.
Note: Refer to "Pr5.20" for the instructions on "Command unit" and "Encoder unit".

4.3.6 Group Pr05 parameters

No. Pr5.00	Name	#2 command frequency division/multiplication numerator			Setting enabled	Immediately enabled	Data range	$0-2^{30}$
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

No. Pr5.01	Name	#3 command frequency division/multiplication numerator			Setting enabled	Immediately enabled	Data range	$0-2^{30}$
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

No. Pr5.02	Name	#4 command frequency division/multiplication numerator			Setting enabled	Immediately enabled	Data range	$0-2^{30}$
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set the 2nd - 4th numerators of frequency division/multiplication of command pulse input.
Valid when Pr0.08"Command pulse per circle of motor rotation"=0 or in full-closed loop control.
When the set value is 0 in position control, the encoder resolution is set as the numerator.
When the set value is 0 in full-closed loop control, the ratio of numerator to denominator is 1:1.

No. Pr5.03*	Name	Pulse output frequency division denominator			Setting enabled	Re-electrifying	Data range	0-16777216
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

No. Pr5.04*	Name	Driver inhibiting input setting			Setting enabled	Re-electrifying	Data range	0-2
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

Set the drive inhibiting input (POT, NOT) action.

Set value	Action
0	POT→ positive drive inhibiting NOT→ drive inhibiting in negative direction
1	Invalid POT and NOT
2	Err38.0"Drive inhibiting input protection" will occur when POT or NOT is input

No. Pr5.05*	Name	Time sequence when the drive disabled is valid			Setting enabled	Re-electrifying	Data range	0-2
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

Set the state during deceleration and after stop when the drive inhibiting input (POT, NOT) has been input and Pr5.04"Drive inhibiting input setting"=0.

〈Details of Pr5.05"Time sequence in drive inhibiting"〉

Pr5.04	Pr5.04	Slowing down	After stopping	Content of deviation counter
0	0	Dynamic brake action	Torque command in drive disabled direction=0	Keep up
	1	Torque command in drive disabled direction=0	Torque command in drive disabled direction=0	Keep up
	2	Stop immediately	Torque command in drive disabled direction=0	Clearing after deceleration

No. Pr5.06	Name	The time sequence when the servo enable is switched off			Setting enabled	Immediately enabled	Data range	0-9
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	9

Set the state during acceleration and after stopwhen the servo enable has been turned off

Set value	During acceleration *3	After stopping	Position deviation
0	Dynamic brake (DB) action	Dynamic braking (DB) action	Clear *4
1	Free operation (DB OFF)	Dynamic braking (DB) action	Clear *4
2	Dynamic brake (DB) action	Free (DB OFF)	Clear *4
3	Free operation (DB OFF)	Free (DB OFF)	Clear *4
4	Dynamic brake (DB) action	Dynamic braking (DB) action	Hold *2
5	Free operation (DB OFF)	Dynamic braking (DB) action	Hold *2
6	Dynamic brake (DB) action	Free (DB OFF)	Hold *2
7	Free operation (DB OFF)	Free (DB OFF)	Hold *2
8	Immediate stop *1	Dynamic braking (DB) action	Clear *4
9	Immediate stop *1	Free (DB OFF)	Clear *4

1. The so-called immediate stop is to achieve the effect of the control when the servo enable is switched on. The torque command at this point is limited by Pr5.11 "Torque setting at immediate stop".
2. Err24.0"Excessive positional deviation protection" will occur when the position command is issued continuously in the servo enable off state or when there is position deviation in the continuous motor operation. In addition, if the servo enable is switched on in excessive position deviation state, the motor will operate at high speed to control the deviation to 0. Please fully keep the position deviation before use.
3. The so-called decelerating is to reduce the motor action to the speed below 30r/min. When the speed drops below 30r/min and changes after stopping, it will not be affected by the speed of the motor but follow the state after stopping.
4. The position deviation is always kept cleared.

Note:

Perform action according to Pr5.10"Alarm time sequence" in case of error during servo enable off. If the main power is switched off during servo enable off, follow Pr5.07"Main power off time sequence".

No. Pr5.07	Name	Main power off time sequence			Setting enabled	Immediately enabled	Data range	0-9
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set the state during acceleration and after stop after the main power is cut off

The set value and actions of Pr5.07 and the handling of the deviation counter are the same as those of Pr5.06 (main power off time sequence).

Note:

1. Perform action according to Pr5.10"Alarm time sequence" in case of alarm during the main power is cut off.
2. When the main power is cut off and the servo is switched on, Err13.1"Insufficient voltage exception of main power supply" will occur when Pr5.08"LV trigger selection when the main power is off"=1, so perform action according to Pr5.10"Alarm time sequence".

No. Pr5.08	Name	LV trigger selection when the main power is cut off			Setting enabled	Immediately enabled	Data range	0-3
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

Select LV trigger or servo enable off in the main power alarm.

	Set value	Function
bit0	0	Set the servo enable off based on Pr5.07 and then restore to servo on when the main power is switched on again.
	1	Err13.1 (insufficient voltage protection of main power) detection.
bit1	0	The main power off alarm is only detected in the servo enable start state.
	1	The main power off alarm is detected at normal time.

Note:

This parameter is invalid when Pr5.09 (Main power off detection time) = 2000.

If Pr5.09 set time is too long and the voltage between P and N of the main power rectification part drops below the specified value before the main circuit break is detected, it is not related to Pr5.08 setting and Err13.1(Insufficient voltage protection of main power) will occur.

During using, select mode 0 or 1; 0: when the main power supply lacks two phases, POWEROFF flag bit will be provided without alarm; 1: when the main power supply lacks two phases, POWEROFF flag bit will not be provided, but Err13.1 will occur;

No. Pr5.09*	Name	Main power off detection time			Setting enabled	Re-electrifying	Data range	70-2000
	Accessibility	RW	Unit	ms	Correlation model	ALL	Factory default	70

Set the time required to detect the circuit break when the main power supply continues in the circuit break state.
Invalid main power off detection when the set value is 2000.

No. Pr5.10	Name	Time sequence at alarm			Setting enabled	Immediately enabled	Data range	0-7
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set the state during acceleration and after stop in case of alarm.

Set value	During acceleration *3	After stopping	Position deviation
0	Dynamic brake (DB) action	Dynamic brake (DB) action	Hold *1
1	Free operation (DB OFF)	Dynamic brake (DB) action	Hold *1
2	Dynamic brake (DB) action	Free (DB OFF)	Hold *1
3	Free operation (DB OFF)	Free (DB OFF)	Hold *1
4	Action A: Stop immediately Action B: DB action *2	Dynamic brake (DB) action	Hold *1
5	Action A: Stop immediately Action B: DB action *2	Dynamic brake (DB) action	Hold *1
6	Action A: Stop immediately Action B: DB action *2	Free (DB OFF)	Hold *1
7	Action A: Stop immediately Action B: DB action *2	Free (DB OFF)	Hold *1

1. Position deviation is held when the alarm occurs and cleared when the alarm is cleared.
2. Actions A and B indicate whether to stop immediately when the alarm occurs. In case of alarm corresponding to immediate stop, stop immediately according to action A if the set value is 4 - 7. In case of alarm not corresponding to immediate stop, switch to the dynamic brake (DB) action specified by action B or turn to idling instead of immediate stop. Keep the main circuit power until deceleration stops.
3. The so-called decelerating is to reduce the motor action to the speed below 30r/min.

No. Pr5.11	Name	Torque setting at immediate stop			Setting enabled	Immediately enabled	Data range	0-500
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	0

Set torque limit at immediate stop.
Note: When the set value is 0, it applies to the torque limit during normal operation.

No. Pr5.12	Name	Overload level setting			Setting enabled	Immediately enabled	Data range	0-500
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	0

Set the overload level. When the set value is 0, the overload level is set to 115[%].
Set to 0 for normal use. Set the level only when the overload level needs to be reduced.
The set value for this parameter should be limited to 115[%] of the motor rating. A value greater than 115[%] cannot be set.

No. Pr5.13	Name	Overspeed level setting			Setting enabled	Immediately enabled	Data range	0-20000
	Accessibility	RW	Unit	rpm	Correlation model	ALL	Factory default	0

Err26.0"Overspeed protection" will occur if the motor speed exceeds this set value.
When the set value is 0, the overspeed level is 1.2 times of the maximum speed of the motor.

No. Pr5.14	Name	Movable range setting of motor			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	0.1r	Correlation model	P	Factory default	10

Set the range of possible motor action corresponding to the position command input range.
Err34.0"Motor moving range setting protection" will occur when this set value is exceeded.

No.	Name	Reading setting of control input	Setting	Re-electrifying	Data range	0-3

Pr5.15*		signal			enabled			
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Select the reading cycle of the control input signal.

Set value	Signal reading cycle
[0]	0.25ms
1	0.5ms
2	1ms
3	2ms

However, the deviation counter clear input (CL) and command pulse inhibiting input (INH) are excluded.

No. Pr5.16*	Name	Alarm clear input setting			Setting enabled	Re-electrifying	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Select the identification time of alarm clear input (A-CLR).

Set value	Signal reading cycle
[0]	120ms
1	According to Pr5.15"I/F Read filter"

No. Pr5.17	Name	Counter clear input mode			Setting enabled	Immediately enabled	Data range	0-4
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	3

Set the reset condition of the deviation counter clear input signal.

Set value	Signal reading cycle
0	Invalid
1	Level reset (read filter not available)
2	Level reset (read filter available)
3	Edge reset (read filter not available)
4	Edge reset (read filter available)

Note: Refer to Section 3.4.3 Deviation counter input parameter setting for the necessary signal width/time input by the deviation counter

No. Pr5.18	Name	Command pulse input mode invalid setting			Setting enabled	Immediately enabled	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	1

Select valid/invalid for command pulse inhibiting input.

Set value	INH
1	Valid
0	Invalid

No. Pr5.19*	Name	Command pulse prohibition input read setting			Setting enabled	Re-electrifying	Data range	0-5
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Select the signal read cycle of command pulse prohibition input.
The state of each signal with a set read cycle is updated when the number of complex signals is the same.

Set value	Signal reading cycle
0	0.250ms, 3 consecutive times
1	0.500ms, 3 consecutive times
2	1.0ms, 3 consecutive times
3	2.0ms, 3 consecutive times
4	0.250ms, 1 read
5	0.250ms, 2 consecutive times

TIPS Note:

With long read cycle, the possibility of error action due to noise is reduced, but the responsiveness of corresponding signal input is reduced.

No.	Name				Setting enabled		Data range	
No. Pr5.20*	Name	Position setting unit selection			Setting enabled	Re-electrifying	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Select the setting unit of position completion range and excessive position deviation.

Set value	Signal reading cycle
0	Command unit
1	Encoder unit

Notice:
The command unit is the unit 1 of the command input 1 pulse from the upper device.
For this purpose, the encoder unit is unit 1 of the encoder 1 pulse.
The electronic gear ratio set by the command frequency division and multiplication function (electronic gear) is R, as shown below.

Command unit ×R = encoder unit

Example, the factory default state in the use of 23bit encoder

$R=\frac{2^{23}}{10000}$, so command unit $\times\frac{2^{23}}{10000}$= encoder unit.

No.	Name				Setting enabled		Data range	
No. Pr5.21	Name	Torque limit selection			Setting enabled	Immediately enabled	Data range	0-6
	Accessibility	RW	Unit	-	Correlation model	P/S	Factory default	1

Set the selection mode of torque limit.

<table>
<tr><th>Set value</th><th>Positive direction</th><th>Negative direction</th></tr>
<tr><td>0</td><td>P-ATL(0 - 10V)</td><td>N-ATL(-10 - 0V)</td></tr>
<tr><td>1</td><td colspan="2">1st torque limit (Pr0.13)</td></tr>
<tr><td>2</td><td>1st torque limit (Pr0.13)</td><td>2nd torque limit (Pr5.22)</td></tr>
<tr><td>3</td><td colspan="2">TL-SEL OFF→ 1st torque limit (Pr0.13)
TL-SEL ON→ 2nd torque limit (Pr5.22)</td></tr>
<tr><td>4</td><td>P-ATL(0 - 10V)</td><td>N-ATL(0 - 10V)</td></tr>
<tr><td>5</td><td colspan="2">P-ATL(0 - 10V)</td></tr>
<tr><td rowspan="4">6</td><td colspan="2">TL-SEL OFF</td></tr>
<tr><td>1st torque limit (Pr0.13)</td><td>2nd torque limit (Pr5.22)</td></tr>
<tr><td colspan="2">TL-SEL ON</td></tr>
<tr><td>Torque limit on external input in positive direction (Pr5.25)</td><td>Torque limit on external input in negative direction (Pr5.26)</td></tr>
</table>

No.	Name				Setting enabled		Data range	
No. Pr5.22	Name	2nd torque limit			Setting enabled	Immediately enabled	Data range	0-500
	Accessibility	RW	Unit	%	Correlation model	P/S	Factory default	500

Set the 2nd torque limit value of the motor output torque.
In addition, the parameter values are limited by the maximum torque of the applicable motor.

No.	Name				Setting enabled		Data range	
No. Pr5.23	Name	Torque limit switching setting 1			Setting enabled	Immediately enabled	Data range	0-4000
	Accessibility	RW	Unit	ms/ 100%	Correlation model	P/S	Factory default	0

Set the rate of change (slope) from 1 to 2 when switching the torque limit.

No.	Name				Setting enabled		Data range	
No. Pr5.24	Name	Torque limit switching setting 2			Setting enabled	Immediately enabled	Data range	0-4000
	Accessibility	RW	Unit	ms/ 100%	Correlation model	P/S	Factory default	0

Set the rate of change (slope) from 2 to 1 when switching the torque limit.

No.	Name				Setting enabled		Data range	
No. Pr5.25	Name	Positive torque limit on external input			Setting enabled	Immediately enabled	Data range	0-500
	Accessibility	RW	Unit	%	Correlation model	P/S	Factory default	500

Set the torque limit in positive direction in TL-SEL input when Pr5.21"Torque limit selection"=6.

No. Pr5.26	Name	Negative torque limit on external input			Setting enabled	Immediately enabled	Data range	0-500
	Accessibility	RW	Unit	%	Correlation model	P/S	Factory default	500

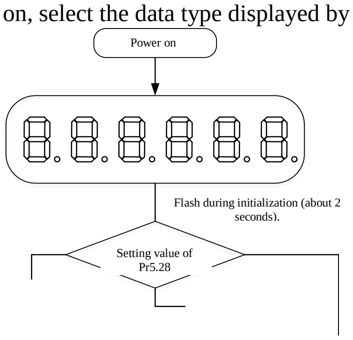
Set the negative torque limit in TL-SEL input when Pr5.21"Torque limit selection"=6.

No. Pr5.27	Name	Analog torque limit input gain			Setting enabled	Immediately enabled	Data range	10-100
	Accessibility	RW	Unit	0.1V/ 100%	Correlation model	P/S	Factory default	30

Set the conversion gain from the voltage [V] applied to the analog torque limit input (P-ATL, N-ATL) to the torque limit [%].

No. Pr5.28*	Name	LED initial state			Setting enabled	Re-electrifying	Data range	0-42
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

At the initial state after the power is switched on, select the data type displayed by the 7-segment LED digital tube on the front panel.



Set value	Content	Set value	Content	Set value	Content
0	Command position deviation	13	Overload ratio	26	Security state monitoring
1	Motor speed	14	Ratio of inertias	27	Factory use
2	Position command speed	15	Factory use	28	Factory use
3	Speed command speed	16	Display of number of input/output signal changes	29	Factory use
4	Torque command	17	Absolute encoder data	30	Factory use
5	Encoder feedforward pulse sum	18	Factory use	31	Factory use
6	Sum of command pulses level	19	Factory use	32	Version number of motor list software
7	Control mode	20	Position deviation (encoder unit)		
8	Input and output signal state	21	Voltage between PN		
9	Analog input value	22	Software version		
10	Alarm reason and history	23	Driver serial No.		
11	Warning number	24	Motor Serial No.		
12	Factory use	25	Factory use		

No. Pr5.29*	Name	RS232 communication baud rate setting			Setting enabled	Re-electrifying	Data range	0-7
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	2

Reserved

No.	Name	RS485 communication baud rate setting			Setting enabled	Re-electrifying	Data range	0-7
Pr5.30*	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	2

Set the communication wave speed of RS485 communication.

Set value	Baud rate
0	2400bps
1	4800bps
[2]	9600bps
3	19200bps
4	38400bps
5	57600bps
6	115200bps
7	230400bps

Bit error rate of baud rate is:
2400 - 38400bps ±0.5%,
57600 - 115200bps ±2%.
Note) When non-Modbus communication is (Pr5.37=0), 9600bps internally if the set value is 7.

No.	Name	Axis address.			Setting enabled	Re-electrifying	Data range	0-127
Pr5.31*	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

In multi-axis control, the server needs to identify which axis to communicate with when communicating with upper host computer and other upper hosts. This parameter can be used to set the number of the axis.

No.	Name	Maximum command pulse input setting/digital filter setting			Setting enabled	Immediately enabled	Data range	20-4000
Pr5.32*	Accessibility	RW	Unit	Kpulse/s	Correlation model	P	Factory default	500

The filter can filter the pulse input signal to reduce the interference. When the positioning is not accurate and the motor is enabled to jitter, this parameter must be set; the larger the value is, the smaller the effect becomes. It is generally recommended to set this value to 200.

No.	Name	Pulse regeneration output limit setting			Setting enabled	Re-electrifying	Data range	0-1
Pr5.33*	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set valid/invalid detection of Err28.0"Pulse regeneration limit protection".

Set value	Content
0	Invalid
1	Valid

No.	Name	Internal use			Setting enabled	Immediately enabled-	Data range	-
Pr5.34	Accessibility	RW	Unit	-	Correlation model	-	Factory default	-

Used by manufacturer.

No.	Name	Front panel lock setting			Setting enabled	Re-electrifying	Data range	0-1
Pr5.35*	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Lock operation through front panel.

Set value	Content
[0]	Front panel operation is not limited
1	Front panel operation is locked

No.	Name	Modbus communication setting			Setting enabled	- Immediately enabled	Data range	0-5
Pr5.38	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set the odevityEven/Odd/None and stop bit length (1bit/2bit) of Modbus communication.

Set value	Content	Set value	Content
[0]	Even/1bit	3	Odd/2bit

1	Even/2bit	4	None/1bit
2	Odd/1bit	5	None /2bit

No. Pr5.42	Name	Modbus broadcast setting			Setting enabled	- Immediately enabled	Data range	-32768 - 32767
	Accessibility	RW	Unit	-	Correlation model	-	Factory default	0

Fixed to 0.

No. Pr5.36 - Pr5.55	Name	Internal use			Setting enabled	Immediately enabled-	Data range	-
	Accessibility	RW	Unit	-	Correlation model	-	Factory default	-

All used by manufacturer. Please use the factory default.

No. Pr5.50	Name	Brake delay time at startup			Setting enabled	Immediately enabled-	Data range	0-10000
	Accessibility	RW	Unit	-	Correlation model	-	Factory default	100

It is used to set the brake delay time at the motor startup, and the delay time of brake DO on after enabling.

No. Pr5. 56	Name	Deceleration time setting at Slow Stop			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	ms/(1000rpm)	Correlation model	ALL	Factory default	0

It is used to set the brake delay time at the motor startup, and the delay time of brake DO on after enabling.

No. Pr5.57	Name	S acceleration and deceleration setting at Slow Stop			Setting enabled	Immediately enabled	Data range	0-10000
	Accessibility	RW	Unit	ms	Correlation model	ALL	Factory default	0

Set the S corner time for deceleration at Slow Stop

4.3.7 Group Pr06 parameters

No. Pr6.00	Name	Analog torque feedforward conversion gain			Setting enabled	Immediately enabled	Data range	0-100
	Accessibility	RW	Unit	0.1V/100%	Correlation model	P/S	Factory default	0

Set the input gain of the analog torque feedforward.
0 - 9 is invalid.

〈Example of use of analog torque feedforward〉

The analog torque feedforward takes effect if bit5 of Pr6.10"Function extension setting" is set to 1. In addition, the function is invalid when the analog input 3 is used for other functions (e.g. analog torque limit).
The voltage [V] applied to the analog input 3 is converted to the torque by using Pr6.00 "Analog torque feedforward gain setting" and is added to the torque command [%].
The positive voltage will produce the torque in CCW direction and the negative voltage will produce the torque in CW direction.
The conversion from the input voltage [V] of analog input 3 to the torque command [%] of the motor is expressed by the following formula.

Torque command [%]=100×input voltage [V]/(Pr6.00 set value ×0.1)

No. Pr6.02	Name	Excessive speed deviation setting			Setting enabled	Immediately enabled	Data range	0-20000
	Accessibility	RW	Unit	rpm	Correlation model	P	Factory default	0

If the speed deviation (difference between the internal position command speed and actual speed) exceeds this set value, Err24.2(excessive speed deviation protection) will occur.
If the set value is 0, excessive speed deviation protection cannot be detected.

No.	Name	JOG trial run command speed			Setting enabled	Immediately enabled	Data range	0-500
Pr6.04	Accessibility	RW	Unit	rpm	Correlation model	ALL	Factory default	300

Set the command speed in JOG trial run (speed control).

No.	Name	Valid time of third position gain			Setting enabled	Immediately enabled	Data range	0-10000
Pr6.05	Accessibility	RW	Unit	0.1ms	Correlation model	P	Factory default	0

・Set the time when the third gain becomes valid.

・If not used, set to Pr6.05 = 0 and Pr6.06 = 100.

・Valid only in position control/full-closed loop control.

No.	Name	Third position gain ratio			Setting enabled	Immediately enabled	Data range	50-1000
Pr6.06	Accessibility	RW	Unit	%	Correlation model	P	Factory default	100

・Set the ratio of the third gain against the 1st gain.

・Third gain = 1st gain ×Pr6.06/100

No.	Name	Torque command weighted arithmetic mean			Setting enabled	Immediately enabled	Data range	-100-100
Pr6.07	Accessibility	RW	Unit	%	Correlation model	P/S	Factory default	0

・Using a control mode other than torque control, set the eccentric load compensation value that is constantly added to the torque command.

・Update this parameter when the vertical axis mode of real-time automatic adjustment is valid.

No.	Name	Positive torque compensation value			Setting enabled	Immediately enabled	Data range	-100-100
Pr6.08	Accessibility	RW	Unit	%	Correlation model	P	Factory default	0

・Set the dynamic friction compensation value added to the torque command when receiving the positive position command in the position control and full-closed loop control mode.

・Update this parameter when the friction compensation mode of real-time automatic adjustment is valid.

No.	Name	Negative torque compensation value			Setting enabled	Immediately enabled	Data range	-100-100
Pr6.09	Accessibility	RW	Unit	%	Correlation model	P	Factory default	0

・Set the dynamic friction compensation value added to the torque command when receiving the negative position command in the position control and full-closed loop control mode.

・Update this parameter when the friction compensation mode of real-time automatic adjustment is valid.

No.	Name	Function extension setting			Setting enabled	Immediately enabled	Data range	0-32768
Pr6.10	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Each function is set in bit units.

	Function	Set value	
		0	1
bit0	Not used	Please fix bit 0	
bit1	Not used	Please fix bit 0	
bit3	Inertia ratio switching	Invalid	Valid
bit5	Analog torque FF	Invalid	Valid
bit10	PWM delay in fault shutdown	Invalid	Valid
bit11	Detection of encoder overheat	Invalid	Valid

	abnormality protection		
bit15	slow stop function	Invalid	Valid

* The least bit is bit0

*1. In case of encoder overheating alarm, Err15.1"Encoder overheating exception protection" will occur.

No. Pr6.11	Name	Current response setting			Setting enabled	Re-electrifying	Data range	10-300
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	100

Perform micro-adjustment to the current response.
Improve the current response by setting this parameter above 100%.

No. Pr6.13	Name	2nd inertia ratio			Setting enabled	Re-electrifying	Data range	0-10000
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	250

Set the 2nd inertia ratio.
Set the ratio of load inertia to the rotor inertia of the motor.

Pr6.13=(load inertia / rotor inertia) ×100(%)

Note:

When the inertia ratio is set correctly, the setting unit of PR1.01 and PR1.06 is (Hz). When Pr0.04 inertia ratio is larger than the actual one,

the setting unit of the speed loop gain will be larger; when the ratio is smaller than the actual one, the setting unit will be smaller.

No. Pr6.14	Name	Immediate stop time when alarming			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	ms	Correlation model	ALL	Factory default	200

Set the allowable time to immediate stop upon alarm.
Turn to mandatory alarm state if this set value is exceeded.
When the set value is 0, turn to alarm stop state immediately rather than immediate stop.
Note: Set to 0 to make the motor stop freely.

No. Pr6.15	Name	2nd overspeed level setting			Setting enabled	Immediately enabled	Data range	0-20000
	Accessibility	RW	Unit	rpm	Correlation model	ALL	Factory default	0

Err26.1"2nd overspeed protection" will occur if the motor speed exceeds this set value.
When the value is set to 0, it is 1.2 times of the maximum speed of the motor.

No. Pr6.16 *	Name	Factory use			Setting enabled	Re-electrifying -	Data range	-
	Accessibility	RW	Unit	-	Correlation model	-	Factory default	0

Fix to 0.

No. Pr6.17 *	Name	Front panel parameter write			Setting enabled	Re-electrifying	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Select EEPROM write rules when parameters of the front panel change.

Set value	Write selection
[0]	EEPROM write not simultaneously
1	EEPROM write simultaneously

No. Pr6.18 *	Name	Waiting time of connecting the power			Setting enabled	Re-electrifying	Data range	0-100
	Accessibility	RW	Unit	0.1s	Correlation model	ALL	Factory default	0

Set the initialization time after power on by standard 1.5s +α.

Example, when the set value is 10, 1.5s + (10×0.1s)= about 2.5s.

No. Pr6.19 *	Name	Encoder Z-phase setting			Setting enabled	Re-electrifying	Data range	0-32768
	Accessibility	RW	Unit	pulse	Correlation model	ALL	Factory default	0

Adjust the phase Z width of the encoder when the number of output pulses per circle of motor rotation after the pulse output frequency division is not an integer.

No. Pr6.20 - Pr6.22	Name	Internal use			Setting enabled	Re-electrifying -	Data range	-
	Accessibility	RW	Unit	-	Correlation model	-	Factory default	-

No. Pr6.23	Name	Load variation compensation gain			Setting enabled	Immediately enabled	Data range	-100-100
	Accessibility	RW	Unit	%	Correlation model	P/S	Factory default	0

Fix to 0.

No. Pr6.24	Name	Load variation compensation filter			Setting enabled	Immediately enabled	Data range	10-2500
	Accessibility	RW	Unit	0.01ms	Correlation model	P/S	Factory default	53

Set the filter time constant corresponding to load changes.

No. Pr6.27*	Name	Warning latch (hold) time selection			Setting enabled	Re-electrifying	Data range	0-10
	Accessibility	RW	Unit	s	Correlation model	ALL	Factory default	5

Set the warning latch (hold) time.

Set value	Content	
0	Infinite latch (hold) time	
1	Latch (hold) time	1[s]
2		2[s]
3		3[s]
4		4[s]
5		5[s]
6		6[s]
7		7[s]
8		8[s]
9		9[s]
10		10[s]

No. Pr6.28*	Name	Special function selection			Setting enabled	Re-electrifying	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Select valid/invalid Block action function.

Set value	Content
0	Block action is invalid
1	Block action is invalid

No. Pr6.30 - Pr6.37	Name	Internal use			Setting enabled	- Immediately enabled	Data range	-
	Accessibility	RW	Unit	-	Correlation model	-	Factory default	-

No. Pr6.38*	Name	Warning mask setting			Setting enabled	Re-electrifying	Data range	-32768 - 32767
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	4

Set the warning detection mask. If the corresponding bit is set to 1, the corresponding warning detection is invalid.

No.	Name	Internal use			Setting enabled	Re-electrifying -	Data range	-
Pr6.39*	Accessibility	RW	Unit	-	Correlation model	-	Factory default	-

No.	Name	Viscous friction compensation gain			Setting enabled	Immediately enabled	Data range	0-10000
Pr6.50	Accessibility	RW	Unit	0.1%/(10000 r/min)	Correlation model	ALL	Factory default	0

The command speed is multiplied by this set value, and the torque command is added to the complement.
Unit [Rated torque 0.1%/(10000 r/min)].

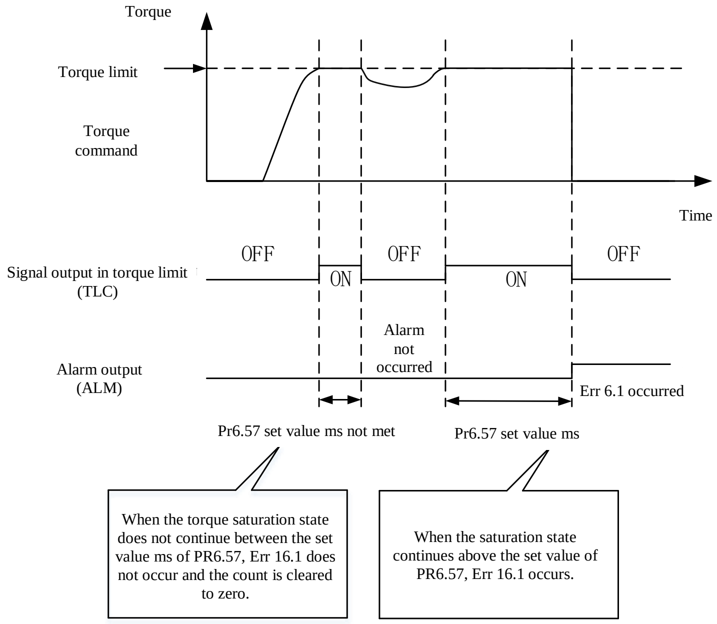
No.	Name	Waiting time for immediate stop			Setting enabled	Immediately enabled	Data range	0-10000
Pr6.51	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set the time to maintain the motor power on after the brake release output off (BRK-OFF) when the alarm corresponding to immediate stop occurs.
Note: Set to 0 to make the motor stop freely.

No.	Name	Internal use			Setting enabled	Immediately enabled-	Data range	-
Pr6.52 - Pr6.54	Accessibility	RW	Unit	-	Correlation model	-	Factory default	-

No.	Name	Detection time of torque saturation exception protection			Setting enabled	Immediately enabled	Data range	0-5000
Pr6.57	Accessibility	RW	Unit	-	Correlation model	P/S	Factory default	0

Set the torque saturation exception protection detection time.
When the torque saturation occurs above the set time, Err16.1"Torque saturation exception protection" occurs.
When the set value is 0, this function is invalid and no alarm will occur.
For example, when the set value is 5000, Err16.1 occurs when the torque saturation state lasts for about 5 seconds.
In the torque control mode, this function is invalid and Err16.1 will not occur.
In case of immediate stop alarm, this function is invalid and Err16.1 will not occur.



No.	Name	Internal use			Setting enabled	- Immediately enabled	Data range	-
Pr6.60 - Pr6.76	Accessibility	RW	Unit	-	Correlation model	Immediately enabled-	Factory default	-

No. Pr6.60	Name	2nd vibration control depth		Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set the vibration control depth under the 2nd vibration control function.

No. Pr6.61	Name	1st resonance frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P	Factory default	0

Set the resonance frequency of the 1st model vibration control filter and load.

No. Pr6.62	Name	1st resonance attenuation ratio			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set the resonance attenuation ratio of the 1st model vibration control filter and load.

No. Pr6.63	Name	1st antiresonance frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P	Factory default	0

Set the antiresonance frequency of the 1st model vibration control filter and load.

No. Pr6.64	Name	1st antiresonance attenuation ratio			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set the antiresonance attenuation ratio of the 1st model vibration control filter and load.

No. Pr6.65	Name	1st response frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P	Factory default	0

Set the load response frequency of the 1st model vibration control filter.

No. Pr6.66	Name	2nd resonance frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P	Factory default	0

Set the load response frequency of the 1st model vibration control filter.

No. Pr6.67	Name	2nd resonance attenuation ratio			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set the resonance attenuation ratio of the 2nd model vibration control filter and load.

No. Pr6.68	Name	2nd antiresonance frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P	Factory default	0

Set the antiresonance frequency of the 2nd model vibration control filter and load.

No. Pr6.69	Name	2nd antiresonance attenuation ratio	Setting enabled	Immediately enabled	Data range	0-1000

	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set the antiresonance attenuation ratio of the 2nd model vibration control filter and load.

No. Pr6.70	Name	2nd response frequency			Setting enabled	Immediately enabled	Data range	0-3000
	Accessibility	RW	Unit	0.1Hz	Correlation model	P	Factory default	0

Set the load response frequency of the 2nd model vibration control filter.

No. Pr6.71	Name	3rd vibration control depth			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set the vibration control depth under the 3rd vibration control function.

No. Pr6.72	Name	4th vibration control depth			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	-	Correlation model	P	Factory default	0

Set the vibration control depth under the 4th vibration control function.

4.3.8 Group Pr09 parameters

No. Pr9.00	Name	Online inertia identification mode			Setting enabled	Immediately enabled	Data range	0-3
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set whether online inertia identification is enabled and the update speed of inertia ratio in the online inertia identification

Set value	Regenerative resistor used	Function
0	Disable online inertia identification	
1	Enable online inertia identification and change slowly	Suitable for situations where the actual load inertia ratio is almost constant
2	Enable online inertia identification, and change generally	Suitable for situations where the actual load inertia ratio changes slowly
3	Enable online inertia identification, and change quickly	Suitable for situations where the actual load inertia ratio changes rapidly

No. Pr9.02	Name	Maximum speed of inertia identification			Setting enabled	Immediately enabled	Data range	100-2000
	Accessibility	RW	Unit	rpm	Correlation model	ALL	Factory default	1000

Online inertia identification function can calculate the current inertia value in real time (currently, real-time update has not been set and can be monitored, and it can be changed if real-time update is needed in the future).
The maximum speed of motion required to start online inertia identification is greater than or equal to Pr9.02, the minimum value of which is not lower than 300rpm.

No. Pr9.03	Name	Inertia identification acceleration			Setting enabled	Immediately enabled	Data range	1-10000
	Accessibility	RW	Unit	Ms/krpm	Correlation model	50	Factory default	1000

Set the time of motor accelerating from 0rpm to 1000rpm under offline inertia identification.

No. Pr9.04	Name	Inertia identification waiting time			Setting enabled	Immediately enabled	Data range	1-1000
	Accessibility	RW	Unit	ms	Correlation model	ALL	Factory default	20

No. Pr9.05	Name	Maximum number of motor running circles in inertia identification process			Setting enabled	Immediately enabled	Data range	0-100
	Accessibility	R	Unit	r	Correlation model	ALL	Factory default	1.66

Display the number of motor rotation circles required for reciprocating motion under offline inertia identification. (Read-only parameter)
When the offline inertia identification function is used, the motor running distance set must be greater than the parameter value; otherwise, there may be identification failure.
Attention If the stroke cannot be greater than this value, the maximum inertia identification speed of Pr9.02 can be appropriately reduced or the inertia identification acceleration value of Pr9.03 can be increased.

No. Pr9.06	Name	Online inertia identification time threshold			Setting enabled	Immediately enabled	Data range	1-9999
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	100

Set the inertia ratio update speed in online inertia identification.
The larger the value is, the slower the update speed is, but the higher the identification precision will be.
Attention It is recommended to use the default value, which can be modified as needed to achieve a balance between time and precision.

No. Pr9.17	Name	Self-tuning enable bit			Setting enabled	Immediately enabled	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set whether full self-tuning is enabled.
0: invalid
1: enabled

No. Pr9.18	Name	Self-tuning operation mode			Setting enabled	Immediately enabled	Data range	0-3
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set the direction of motion based on the current position, reciprocating or one-way mode.
0: positive - negative reciprocating
1: negative - positive reciprocating
2: positive - positive one-way
3: negative - negative one-way

No. Pr9.19	Name	Self-tuning response level			Setting enabled	Immediately enabled	Data range	0-5
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

Set the response level of the command, the larger the value, the shorter the positioning time; the smaller the value, the longer the positioning time. But if it is set too large, it may cause system shock. The standard response mode can be used in most applications, and the response level can be improved appropriately for the load with lower rigidity.
0: Low response mode
1: Standard response mode
2: High response level 1
3: High response level 2
4: High response level 3
5: High response level 4

No. Pr9.20	Name	Application type			Setting enabled	Immediately enabled	Data range	0-2
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Select the current load type.
0: Ball screw type load
1: Robot type load
2: Belt type load

No. Pr9.21	Name	Maximum resonance amplitude			Setting enabled	Immediately enabled	Data range	1.0-50.0
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	5.0
Default value 5.0%.								

No. Pr9.22	Name	Low frequency vibration amplitude			Setting enabled	Immediately enabled	Data range	0.1-50.0
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	1.0
Valid when the robot type load is set, which is generally 1.0%~5.0%.								

No. Pr9.23	Name	Maximum torque vibration amplitude			Setting enabled	Immediately enabled	Data range	0.5-10.0
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	2.0
Set the torque smoothness, the greater the value, the stronger the rigidity of the setting, 2.0% by default generally. If the motor noise is large during the trial run after setting, the parameter can be reduced and reset, or the rigidity can be reduced manually.								

No. Pr9.24	Name	Special function enable bit			Setting enabled	Immediately enabled	Data range	0-32767
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0
The enable bits of the corresponding functions of binary bits are as follows: Bit0: load torque feedforward, 0 invalid, 1 enabled Bit1: advanced vibration suppression, 0 invalid, 1 enabled Bit2: speed observation, 0 invalid, 1 enabled Bit3: reserve , 0 invalid, 1 enabled Bit4: online FFT, 0 invalid, 1 enabled Bit5: online inertia identification, 0 invalid, 1 enabled Bit6: nonlinear control, 0 invalid, 1 enabled								

No. Pr9.25	Name	Speed observation bandwidth			Setting enabled	Immediately enabled	Data range	10-1000
	Accessibility	RW	Unit	Hz	Correlation model	ALL	Factory default	50
This function can reduce the noise of the speed, making the torque smoother. The smaller the speed observation bandwidth is, the smoother the speed will be. However, too small bandwidth may lead to instability of the system, which is generally set as the speed loop bandwidth value.								

No. Pr9.26	Name	Vibration frequency			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	Hz	Correlation model	ALL	Factory default	100
Advanced vibration suppression function can suppress the vibration of 100-1000Hz. Pr9.26 is set to the vibration frequency of the system. Ensure that the set load inertia ratio is correct.								

No. Pr9.29	Name	Nonlinear control integration time			Setting enabled	Immediately enabled	Data range	0-32767
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0
Nonlinear control can improve servo responsiveness and reduce positioning time, especially for linear motor. Pr9.29 can eliminate the position following static error, the smaller the value, the stronger the effect. If it is set too small, it may cause the position feedback oscillation, which requires increasing Pr9.29.								

No. Pr9.30	Name	Nonlinear control gain			Setting enabled	Immediately enabled	Data range	0-100
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	0
If Pr9.30 is non-zero value, then the parameter Pr9.29 is invalid. Pr9.30 can eliminate the position following static error. The greater the value, the stronger the effect, and the maximum value is not more than 100%.								

No. Pr9.31	Name	Nonlinear periodic value			Setting enabled	Immediately enabled	Data range	1-100
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	10

Pr9.31 determines the execution cycle of nonlinear control. The larger the value is, the slower the position response is and the smoother the torque is, the vice versa. When nonlinear control is used, if the motor noise is relatively large, Pr9.31 can be appropriately increased; when motor noise permits, Pr9.31 can be reduced to improve the position response performance and reduce the positioning time.

No. Pr9.34	Name	Maximum acceleration limit level			Setting enabled	Immediately enabled	Data range	0-7
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	7

Set the upper limit of the maximum acceleration in the process of self-tuning. The smaller the value, the smaller the upper limit of acceleration.
If the application load does not want the acceleration to be too large, the value can be appropriately reduced; or if it is found that the acceleration is too large and the vibration of the machine is too large during the setting process, the setting can be stopped and started again before the value is reduced.

4.3.9 Group Pr10 parameters

No. Pr10.02	Name	Motor type			Setting enabled	Re-electrifying	Data range	0-2
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

This parameter is used to set the type of motor
0: rotary motor
1: linear motor
2: simulative motor

No. Pr10.03	Name	Rated power of motor			Setting enabled	Re-electrifying	Data range	0.01 - 200.00
	Accessibility	RW	Unit	kw	Correlation model	ALL	Factory default	0.75

Parameters Pr10.03 - Pr10.09 are internal characteristic parameters of the motor. When a custom motor is used, these parameters need to be set correctly according to the motor nameplate. When a preset motor is used, these parameters are read-only.

No. Pr10.04	Name	Rated current of motor			Setting enabled	Re-electrifying	Data range	0.1 - 400.0
	Accessibility	RW	Unit	A	Correlation model	ALL	Factory default	5.0

Set the rated current value of the motor

No. Pr10.05	Name	Rated speed of the motor			Setting enabled	Re-electrifying	Data range	1 - 30000
	Accessibility	RW	Unit	rpm	Correlation model	-	Factory default	3000

Set the rated speed value of the motor

No. Pr10.06	Name	Maximum speed of motor			Setting enabled	Re-electrifying	Data range	1 - 30000
	Accessibility	RW	Unit	rpm	Correlation model	ALL	Factory default	6500

Set the value of the maximum motor speed

No. Pr10.07	Name	Number of pole pairs of motor			Setting enabled	Re-electrifying	Data range	1 - 80
	Accessibility	RW	Unit	Pn	Correlation model	ALL	Factory default	5

Set the number of pole pairs of motor

No. Pr10.08	Name	Rated torque of motor			Setting enabled	Re-electrifying	Data range	0.00 - 1000.00
	Accessibility	RW	Unit	N.m	Correlation model	Re-electrifying	Factory default	2.39
Set the rated torque value of motor								

No. Pr10.09	Name	Stator-phase resistance of motor			Setting enabled	Re-electrifying	Data range	0.00 - 1000.00
	Accessibility	RW	Unit	ohm	Correlation model	ALL	Factory default	0.5
Parameters Pr10.9, Pr10.10, Pr10.11, Pr10.12 and Pr10.13 are internal characteristic parameters of the motor. When a custom motor is used, these parameters need to be set correctly according to the motor nameplate. When a preset motor is used, these parameters are read-only.								

No. Pr10.10	Name	D-axis inductance of motor			Setting enabled	Re-electrifying	Data range	0.00 - 1000.00
	Accessibility	RW	Unit	mH	Correlation model	ALL	Factory default	2.9
Set the D-axis inductance of motor								

No. Pr10.11	Name	Q-axis inductance of motor			Setting enabled	Re-electrifying	Data range	0.00 - 1000.00
	Accessibility	RW	Unit	mH	Correlation model	ALL	Factory default	2.9
Set the Q-axis inductance of motor								

No. Pr10.12	Name	Rotational inertia of motor			Setting enabled	Re-electrifying	Data range	0.00 - 1000.00
	Accessibility	RW	Unit	$kg.cm^2$	Correlation model	ALL	Factory default	1.82
Set the rotational inertia of motor								

No. Pr10.13	Name	EMF constant of motor			Setting enabled	Re-electrifying	Data range	0 - 2000
	Accessibility	RW	Unit	vkr	Correlation model	ALL	Factory default	28
Set the EMF constant of motor								

No. Pr10.14	Name	Motor load analog inertia ratio			Setting enabled	Re-electrifying	Data range	0 - 20000
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	250
This parameter represents the inertia ratio of the analog load when using an analog motor.								

No. Pr10.15	Name	Encoder type			Setting enabled	Re-electrifying	Data range	0-5
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0
Set the type of encoder of the connected motor.								

Set value	Encoder type
0	Tamagawa 2.5M encoder
1	Nikon 2.5M encoder
2	Panasonic encoder
3	ABZ encoder
4	Tamagawa 4M encoder
5	Nikon 4M encoder

No. Pr10.16	Name	Encoder single-turn resolution	Setting enabled	Re-electrifying	Data range	10 - 30

	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	17

Set the single-turn resolution of the absolute position encoder used.

No. Pr10.17	Name	Encoder multi-turn resolution			Setting enabled	Re-electrifying	Data range	0 - 30
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Set the multi-turn resolution of the absolute position encoder used; as regards a single-turn absolute position encoder, this parameter needs to be set as 0.

No. Pr10.18	Name	Encoder zero position angle			Setting enabled	Re-electrifying	Data range	0 - 360
	Accessibility	RW	Unit	°	Correlation model	ALL	Factory default	0.00

This parameter shows the encoder zero position angle of the motor obtained after encoder zero self-learning through "Position angle self-learning".

No. Pr10.19	Name	Encoder fault enable			Setting enabled	Re-electrifying	Data range	0 - 1
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1

Set encoder self-alarm enabled or not except "encoder connection error". In the application where the absolute position information of the motor rotor is not required to be saved after the power failure of the servo system.

No. Pr10.20	Name	Maximum encoder deviation			Setting enabled	Re-electrifying	Data range	100 - 100000
	Accessibility	RW	Unit	inc	Correlation model	ALL	Factory default	100

No. Pr10.21	Name	Encoder fitting alarm enable			Setting enabled	Re-electrifying	Data range	0 - 1
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Encoder fitting alarm enable.

Set value	Encoder fitting alarm enable
0	Invalid
1	Valid

No. Pr10.22	Name	Encoder self-learning current			Setting enabled	Re-electrifying	Data range	1% - 200%
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	100

This parameter is used to set given current magnitude in self-learning. This value is the percentage of the rated current of motor.

No. Pr10.23	Name	Current loop Kp			Setting enabled	Re-electrifying	Data range	0.01-99.99
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	1.00

No. P10.24	Name	Current loop Ti			Setting enabled	Re-electrifying	Data range	0.1-9999.9
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	100.0

No. P10.25	Name	PWM carrier frequency			Setting enabled	Re-electrifying	Data range	5000-20000
	Accessibility	RW	Unit	Hz	Correlation model	ALL	Factory default	10000

No. P10.26	Name	Dead time ns	Setting enabled	Re-electrifying	Data range	1000-10000

	Accessibility	RW	Unit	ns	Correlation model	ALL	Factory default	1600

No. Pr10.27	Name	Input phase loss enable			Setting enabled	Immediately enabled	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

This parameter is used to enable the servo input phase loss detection function.
0: Input phase loss detection forbidden: it disables the function of input phase loss detection of the servo. When the EMC series servo needs to operate in the situation of single-phase input power supply, the parameter shall be set to 0 to prevent the system from being shut down due to the error of input phase loss detection. However, in the case of single-phase power input, the output power and control accuracy of the servo may be affected, which needs to be evaluated in advance.
1: Input phase loss detection enabled: it enables the input phase loss detection of the servo. This function will give an alarm and shut down the machine when it detects the deterioration impact of single-phase power input on the current operation performance of the servo.

No. Pr10.28	Name	External resistance gain			Setting enabled	Immediately enabled	Data range	0-1000
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	0

This parameter is used to increase resistance to external forces and reduce acceleration and deceleration overshoot. The factory default value of this parameter is 0. To adjust P2.026, it is recommended to refer to the following rules:
1. In speed mode, increasing this parameter can reduce speed overshoot.
2. In position mode, lowering this parameter can reduce position overshoot.

No. Pr10.29	Name	Brake voltage			Setting enabled	Immediately enabled	Data range	1-100
	Accessibility	RW	Unit	%	Correlation model	ALL	Factory default	0

This parameter is used to set the ratio of the maintenance voltage at which the switch is opened to the brake supply voltage when the brake module is used.

No. Pr10.30	Name	Phase sequence interchange of phase U and W			Setting enabled	Immediately enabled	Data range	0-1
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

It is used to set whether the phase sequence of phase U and W of the motor are interchanged internally. When the motor phase sequence is reversed, it can be modified by parameters to ensure that the phase sequence wiring does not need to be replaced.
0: normal phase sequence
1: phase sequence interchange

No. Pr10.31	Name	Smoothing reversing time			Setting enabled	Immediately enabled	Data range	10-500
	Accessibility	RW	Unit	ms	Correlation model	ALL	Factory default	100

No. Pr10.32	Name	Incremental encoder resolution			Setting enabled	Immediately enabled	Data range	-2147483648 - 2147483648
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Used to set the number of pulses per circle of rotation of incremental ABZ encoder.

No. Pr10.33	Name	Power-on-angle learning mode			Setting enabled	Immediately enabled	Data range	0-5
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0

Use to change the mode of power-on-angle learning.

No. Pr10.34	Name	Angle compensation coefficient			Setting enabled	Immediately enabled	Data range	0-1000

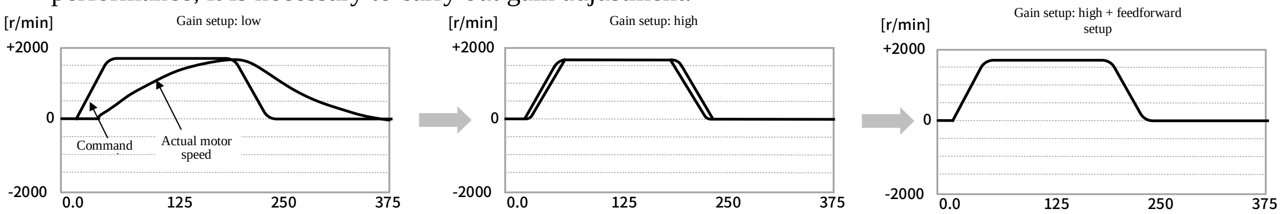
	Accessibility	RW	Unit	-	Correlation model	ALL	Factory default	0
Internal use, generally not set.								

Chapter 5 Servo Adjustment

5.1 Adjustment, steps and types

1. Purpose

The driver needs to make the motor follow the commands from the controller as accurately as possible without delay. In order to make the motor action closer to the command, and maximize the mechanical performance, it is necessary to carry out gain adjustment.



Position loop gain: 20.0
Velocity loop gain: 100.0
Velocity loop integral time constant: 50.0
Velocity feed forward: 0
Inertia ratio: 100

Position loop gain: 100.0
Velocity loop gain: 50.0
Velocity loop integral time constant: 50.0
Velocity feedforward: 0
Inertia ratio: 100

Position loop gain: 100.0
Velocity loop gain: 50.0
Velocity loop integral time constant: 50.0
Velocity feedforward: 50.0
Inertia ratio: 100

Figure 5.1-1 Gain adjustment results with screw

2. Procedures

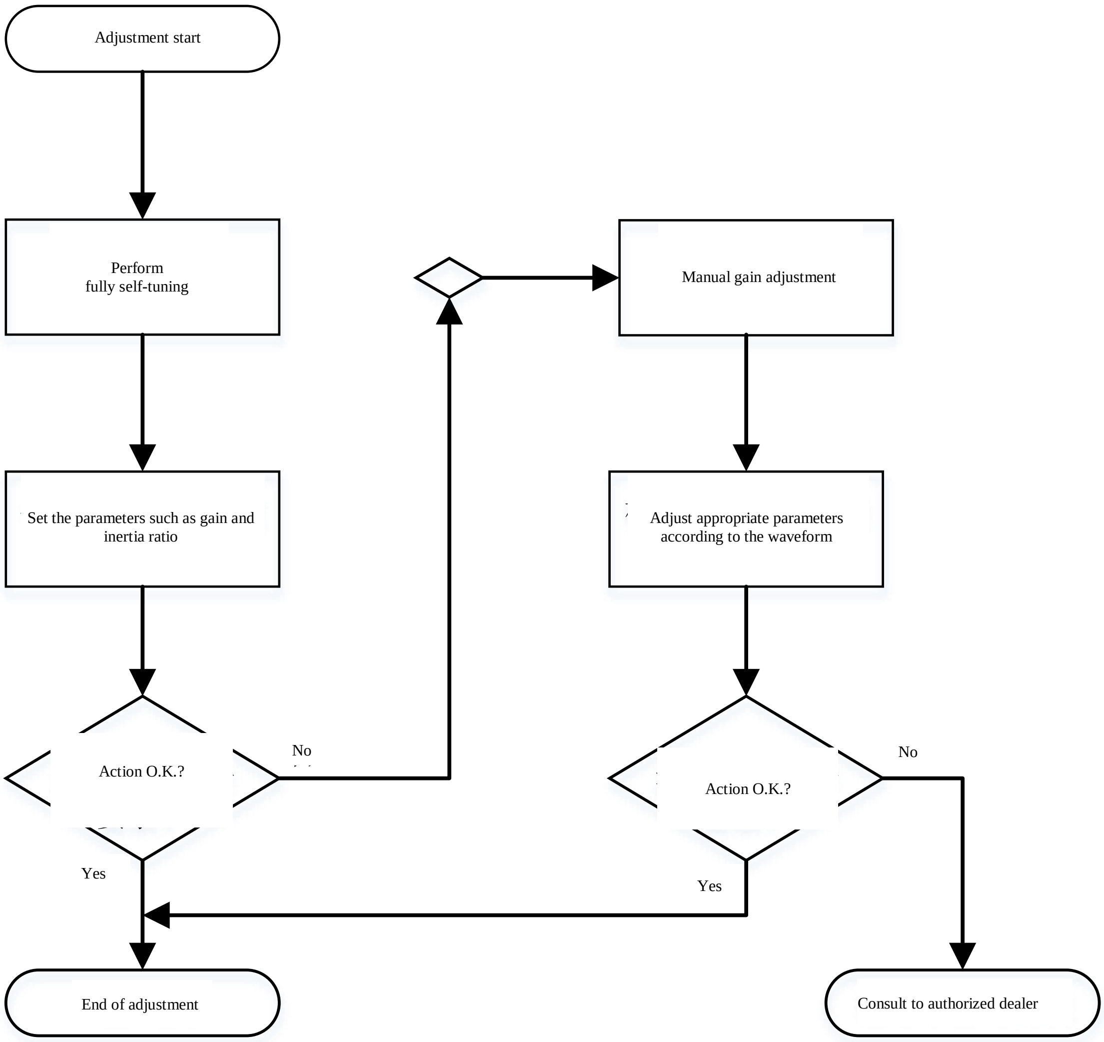


Figure 5.1- 2 Gain adjustment process

3. Type

Function			Explanation	Reference section
Automatic adjustment	fully self-tuning		Achieve offline automatic gain adjustment by one-key automatic tuning. Automatically set the parameters such as rigidity, inertia ratio and friction compensation after setting.	5.2
	Adaptive filter		In the process of motion, infer the resonance frequency from the vibration component expressed on the motor speed, automatically set the parameters of the notch filter and remove the resonant component from the torque command, so as to reduce the vibration of the resonance point.	5.3
Manual adjustment	Manual gain adjustment (basic)		Manual adjustment and re-adjustment can be made when full self-tuning is not possible for gain adjustment due to load conditions or motion modes, and when it is necessary to maximize responsiveness and stability based on machine characteristics.	5.4
		Basic steps	Position control mode adjustment	5.4.2
			Velocity control mode adjustment	5.4.3
			Torque control mode adjustment	5.4.4
		Gain switch Function	Gain switching using internal data or external signal can reduce the vibration at stop, shorten the setting time and improve the command responsiveness.	5.4.5
		Mechanical resonance suppression	When the mechanical rigidity is low, vibration or abnormal sound may occur due to resonance caused by the axis distortion, and sometimes the gain setting cannot be improved. At this time, the resonance can be suppressed by torque command filter and notch filter.	5.4.6
	Manual gain adjustment (application)		When the basic adjustment fails to meet the specification requirements, please use the following application functions to further improve performance.	5.5
		Vibration control function	Vibration control	5.5.1
		Feedforward function	In position control and full-closed loop control mode, the responsiveness can be improved by speed feedforward. In addition, the torque feedforward can improve the response related to speed control.	5.5.2

Remarks: When vibration state (abnormal sound or vibration) occurs, please quickly cut off the power supply or turn to Servo-OFF. Take care.

5.2 Real-time automatic gain adjustment

5.2.1 Outline

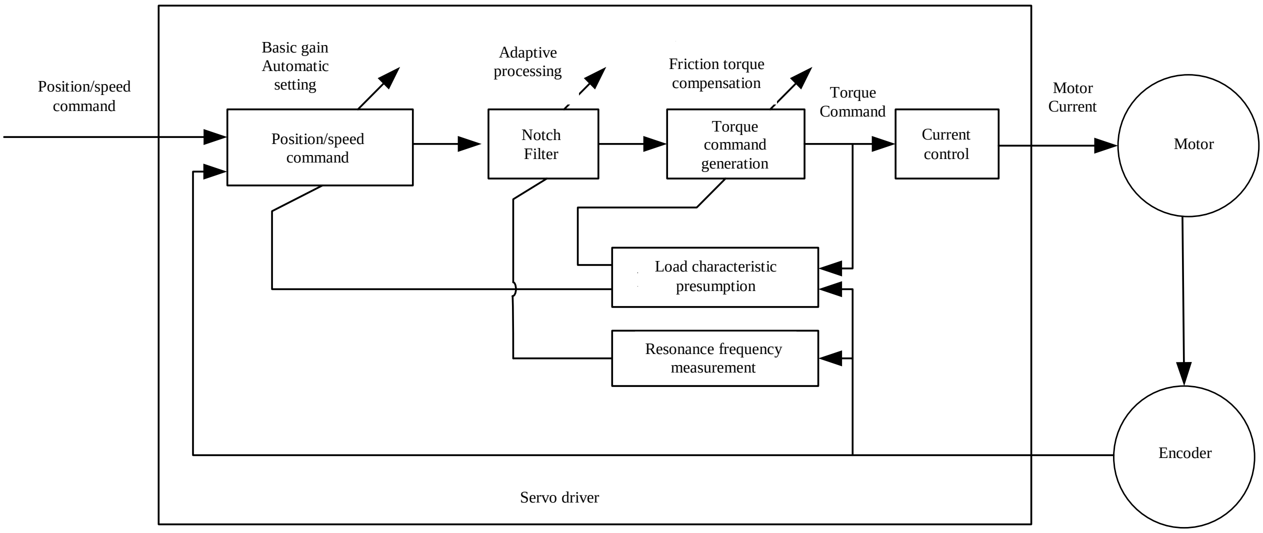


Figure 5.2.1-1 Block diagram of adaptive filter

5.2.2 **Applicable Range**

	Real-time auto-tuning condition
Control mode	Real-time automatic adjustment applies to all control modes.
Other	・Should be in servo-on condition. ・Set the appropriate deviation counter clear, input signal of command input inhibiting, torque limit setting and other parameters outside the control to ensure the normal rotation of the motor without fault.

5.2.3 Operation method

5.2.3.1 Online automatic gain adjustment

1. Precondition:
(1) The correct load inertia ratio has been set (it can be obtained by offline inertia identification, online inertia identification or offline self-tuning; or changed to automatic update of online inertia identification later) within 50 times;
(2) The motor motion distance can exceed 0.5 circle.
2. Operation steps:
(1) Stop motor operation (Servo-OFF);
(2) Enable online gain adaptive adjustment and set Pr0.02 [Real-time automatic adjustment setting] to 1~6;

Set value	Real-time automatic adjustment
0	Invalid
1	Standard mode
2	Positioning mode *1

*1 Velocity and torque controls are the same as in the standard mode.
*2 Torque control is the same as in the standard mode.
*3 Velocity control is the same as in the vertical axis mode
Torque control is

		the same as in the standard mode
3	Vertical axis mode *2	
4	Friction compensation mode *3	
5	Load characteristic measurement	

① Enable adaptive notch and set Pr2.00 [Adaptive filter mode] to 1 or 2 notch filters valid;
② Step 3: Enable the servo and make mechanical action according to usual conditions;
③ Step 4: Increase the setting value of Pr0.03 [Real-time automatic adjustment rigid setting] to improve the response of the motor.
Please observe the positioning time and vibration state and adjust to the most appropriate value.
④ The results will be saved automatically when the appropriate results are achieved.

[Cautions]
The high frequency abnormal sound is not abnormal after the servo is enabled or after the Pr0.03 [Real-time automatic adjustment rigid setting] set value is increased. The notch filter has suppressed the vibration and can continue to improve the rigidity. If continuous vibration occurs, the following measures should be taken:
1. Reduce Pr0.03 [Real-time automatic adjustment rigid setting] set value;
2. If there is still abnormal sound after rigidity reduction, turn off the third and fourth notch filters.

5.2.3.2 Offline gain adjustment

1. Precondition:
(1) The load inertia ratio is less than 50 times;
(2) The motion distance is more than 0.5r;
(3) Single-axis motion can be carried out through the servo upper Ω Master. Online setting mode can be adopted for the gantry structure where two axes must move simultaneously.
2. How to Operate:
(1) Confirm self-tuning related parameters, which are the default parameters in most applications;
(2) Set the appropriate motion distance;
The relative motion distance is input at the target position. The motion direction is determined by the positive and negative signs of the parameter Pr9.18 and the motion distance, and the reciprocating movement mode or one-way movement mode is determined by the parameter Pr9.18. Thus, the self-tuning motion trajectory is determined: move for the set relative distance based on the current position.
The greater motion distance in the safe running range limit is better and cannot be less than 0.5r.
[Note] Ensure that the motion distance set is within the range of safe running.
(3) Enable self-tuning
Ensure that it is in the enable interruption state. 1. Select [Fully self-tuning]; 2. Click the [Start] button; 3. Click the [Enable] button. After the above operation, the motor will run automatically according to the set trajectory.
[Note] In the process of self-tuning, speed, acceleration and repeated waiting time will be automatically configured without manual setting, and manual setting will be invalid.
(4) After setting, the motor will automatically stop the enable interruption and save the setting parameters.
Self-tuning of updated parameters

Parameter	Parameter name	Whether it works immediately
Pr.0.03	Real-time automatic adjustment rigid setting	Yes
Pr.0.04	Ratio of inertias	Yes
Pr.1.00	1st position loop gain	Yes
Pr.1.01	1st speed ratio gain	Yes
Pr.1.02	1st speed integral time constant	Yes
Pr.1.03	1st speed detection filter	Yes
Pr.1.04	1st torque filter	Yes
Pr.2.07	2nd notch frequency	Yes
Pr.2.08	Third notch width	Yes
Pr.2.09	Third notch depth	Yes
Pr.2.10	4th notch frequency	Yes
Pr.2.11	4th notch width	Yes
Pr.2.12	4th notch depth	Yes
Pr.9.28	Low frequency vibration	No
Pr.9.35	Positive friction compensation value	No

Pr.9.36	Negative friction compensation value	No
Pr.9.37	Coefficient of viscosity	No
Pr.9.38	Gravity compensation value	No

Yes: the parameter immediately takes effect;
No: display the setting result and need to enable the corresponding function and then assign to the corresponding parameter.
[Cautions]
1. After offline setting, try to conduct the trial run within the full stroke range. 1st run at low speed and low acceleration. If normal, gradually increase the speed and acceleration to the required value.
2. If the motor noise is relatively large during the trial run, it may be caused by the excessive setting of parameter Pr9.23 during the self-tuning, and the rigidity value of parameter Pr0.03 can be appropriately reduced; the parameter Pr.9.23 is reduced before self-tuning again.
3. If the set rigidity is too low, check whether the parameter Pr9.23 is set too small. For the robot load, check again whether the parameter Pr9.22 is set too small. Adjust this parameter and reset.
4. For belt type low rigidity load, if the positioning time cannot meet the demand, the parameter Pr9.19 self-tuning response level can be increased appropriately.

5.2.4 Basic gain parameter setting table

Stiffness	1st gain				2nd gain			
	Pr1.00	Pr1.01	Pr1.02	Pr1.04	Pr1.05	Pr1.06	Pr1.07	Pr1.09
	Position loop gain [0.1/s]	Speed loop gain [0.1Hz]	Speed integral time constant [0.1 ms]	Torque filter time constant [0.01ms]	Position loop gain [0.1/s]	Speed loop gain [0.1Hz]	Speed integral time constant [0.1 ms]	Torque filter time constant [0.01ms]
0	20	15	3700	40	25	15	10000	40
1	25	20	2800	40	30	20	10000	40
2	30	25	2200	40	40	25	10000	40
3	40	30	1900	40	45	30	10000	40
4	45	35	1600	40	55	35	10000	40
5	55	45	1200	40	70	45	10000	40
6	75	60	900	40	95	60	10000	40
7	95	75	700	40	120	75	10000	40
8	115	90	600	40	140	90	10000	40
9	140	110	500	40	175	110	10000	40
10	175	140	400	40	220	140	10000	40
11	320	180	310	40	380	180	10000	40
12	390	220	250	40	460	220	10000	40
13	480	270	210	40	570	270	10000	40
14	630	350	160	40	730	350	10000	40
15	720	400	140	40	840	400	10000	40
16	900	500	120	40	1050	500	10000	40
17	1080	600	110	38	1260	600	10000	40
18	1350	750	90	30	1570	750	10000	40
19	1620	900	80	25	1880	900	10000	40
20	2060	1150	70	20	2410	1150	10000	40
21	2510	1400	60	16	2930	1400	10000	40
22	3050	1700	50	13	3560	1700	10000	40
23	3770	2100	40	11	4400	2100	10000	40
24	4490	2500	40	9	5240	2500	10000	40
25	5000	2800	35	8	5900	2800	10000	35
26	5600	3100	30	7	6500	3100	10000	30
27	6100	3400	30	7	7100	3400	10000	30
28	6600	3700	25	6	7700	3700	10000	25
29	7200	4000	25	6	8400	4000	10000	25
30	8100	4500	20	5	9400	4500	10000	20
31	9000	5000	20	5	10500	5000	10000	20

5.3 Adaptive filter

5.3.1 Outline

In the actual action state, Estimates the resonance frequency from the vibration component in the motor speed and automatically set the parameters of the notch filter with resonance components, hence reduces the resonance vibra-tion.

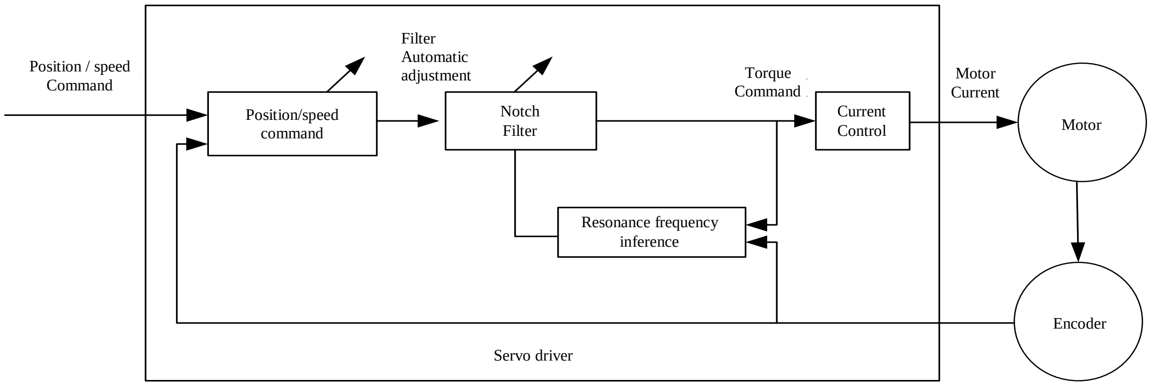


Figure 5.3.1-1 Block diagram of adaptive filter

5.3.2 Applicable Range

	Conditions under which the Adaptive filter is activated
Control mode	・Apply to the mode other than torque control.
Other	・Should be servo-on status. ・Set the deviation counter clear command input inhibiting, torque limit and factors other than control parameters properly, so that enabling the motor to run normally.

5.3.3 Precautions

	Conditions which obstruct adaptive filter action
Resonance point	・When the resonance frequency is less than 3 times the speed response frequency. ・When the resonance peak value is low, or the control gain is low, and the influence on the motor speed is not shown. ・When there are more than 3 resonance points.
Load	・When the motor speed variation of high frequency components is generated under the influence of non-linear factors such as back clearance, .

5.3.4 How to Operate

Please enter an action command when Pr2.00 “Adaptive filter mode setting” is set to a value other than 0.
When the resonance point affects the motor speed, the parameters of the third or the fourth notch filter will be automatically set according to the number of adaptive filters.
Please use the following parameters to set the actions corresponding to the adaptive filter.
When the mode changes, please temporarily set to 0 (invalid) or 4 (clear).

Setup value	No.	Parameter name	Set value	Function

2	00	Adaptive filter mode	0	< Adaptive filter invalid > The adaptive filter is invalid. The parameters associated with the third and fourth notch filters remain as they are.
			1	< 1 adaptive filter valid > 1 adaptive filter is valid. Update the parameters associated with the third notch filter according to the adaption result.
			2	< 2 adaptive filter valid > 2 adaptive filter is valid. Update the parameters associated with the third and fourth notch filters according to the adaption result.
			3	< Resonance frequency measurement mode > Measure the resonance frequency. The measurement result can be used for Ω Master confirmation. The parameters associated with the third and fourth notch filters remain as they are.
			4	< Adaptive result clear > The parameters associated with the third and fourth notch filters are invalid and the adaption result is cleared.

The following parameters are set automatically.

Class	No.	Title name	Function value
2	07	2nd notch frequency	Set to 5000 if no resonance point is found.
2	08	Third notch width	Automatically set the when the adaptive filter is valid.
2	09	Third notch depth	
2	10	4th notch frequency	Automatically set the 1st resonance frequency inferred by the adaptive filter. Set to 5000 if no resonance point is found.
2	11	4th notch width	Automatically set when 2 adaptive filters are valid.
2	12	4th notch depth	

[Cautions]

1. The real-time automatic adjustment is valid after the 1st servo enable is on upon startup. When the rigidity setting is improved, the adaptive filter may have abnormal sound or vibration before it is stabilized, which is not abnormal if the filter can be stabilized immediately. In case of continuous vibration or in case of continuous abnormal sound after repeated action for more than 3 times, please take the following measures.

(1) Write the parameters during normal action in the EEPROM.
(2) Reduce Pr0.03 [Real-time automatic adjustment rigid setting].
(3) Set Pr2.00"Adaptive filter mode setting" to 0 to invalidate the adaptive filter.
(4) Manually set the notch filter.

2. After abnormal sound or vibration, the value of the third notch filter and the fourth notch filter will become very extreme. In this case, invalidate the adaptive filter according to the above method (3), that is, set the set values of Pr2.07 "Third notch frequency" and Pr2.10"Fourth notch frequency" to 5000 (invalid) and then validate the adaptive filter again.

3. Write the third notch filter(Pr2.07 ~ Pr2.09) and fourth notch filter(Pr2.10 ~ Pr2.12) in EEPROM every 30min and switch on again. This data is used as the initial value for automatic adjustment.

5.4 Manual gain adjustment

5.4.1 Overview

ODSAP6 has the aforementioned automatic gain adjustment function. But due to the load and other constraints, the automatic gain adjustment may not be well adjusted to get the suitable gain, or it is required to obtain the best responsiveness and stability together with other loads, then ODSAP6 shall be readjusted. In this chapter, the manual gain adjustment methods for each control mode and function are described.

1. Before manual adjustment

The waveform is observed using the oscillogram function in the software “Ω Master” installed on the computer. It is faster to manually adjust using the software than using the front panel.

Oscillogram function of “Ω Master”

The commands and the action of motor, (velocity, torque command and deviation pulse) can be displayed on the screen as waveform.

Note: The installation and debugging software “Ω Master” can be downloaded from the company homepage.

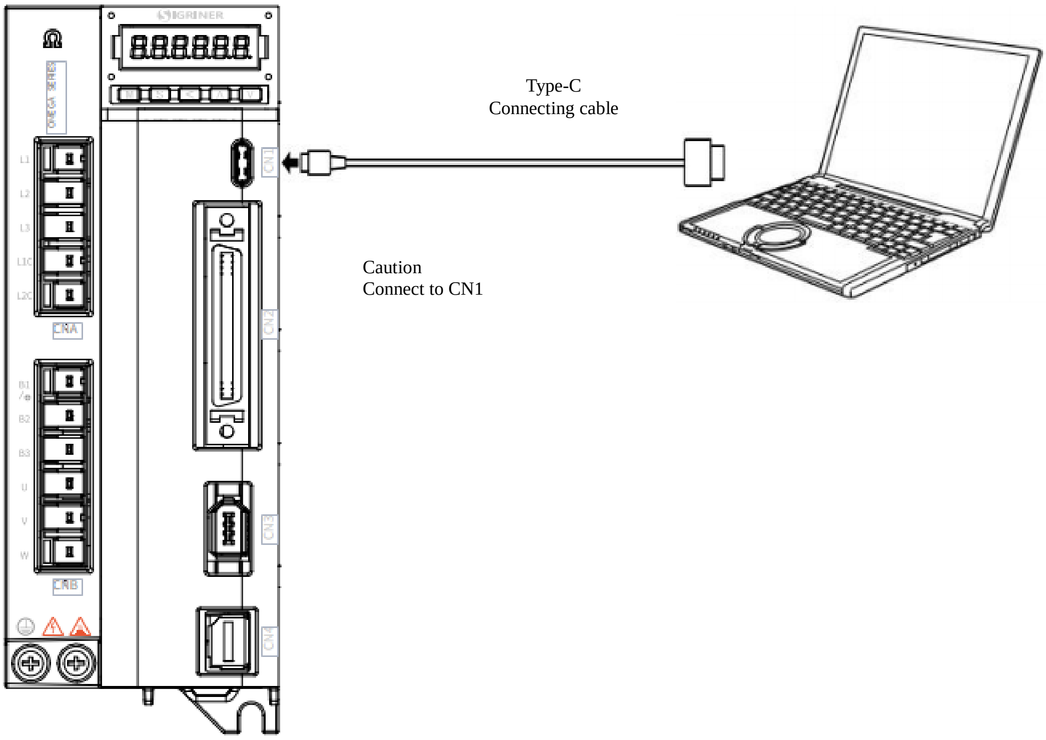


Figure 5.4.1-1 Example of connection between the servo and the upper computer

5.4.2 Adjustment of position control mode

Position control of the Ω series servo is shown in the control block diagram in 3.2.1-1. The position control is adjusted in the following order.

1. Set up the following parameters to the values of the table below.

Parameter No. (Pr)	Title of parameter	Target value	Parameter No. (Pr)	Title of parameter	Target value
1.00	1st position loop gain	48.0	0.04	Inertias ratio	250
1.01	1st speed loop gain	27.0	0.02	Real-time automatic adjustment setting	0
1.02	1st velocity integral time	21.0	2.14	1st damping control	0

	constant	
1.03	1st velocity detection filter	0.1
1.04	1st torque filter	0.4
1.10	Velocity feedforward gain	100.0
1.05	2nd position loop gain	57.0
1.06	2nd velocity loop gain	27.0
1.07	2nd velocity integral time constant	1000.0
1.08	2nd velocity detection filter	0.1
1.09	2nd torque filter	0.4
2.01	1st notch frequency	5000
2.02	1st notch width	2

	frequency	
2.16	2nd damping control frequency	0
1.14	2nd gain setting	1
1.15	Position control switching mode	0
1.16	Delay time of position control switching	1.0
1.17	Level of Position control switching	0
1.18	Position control switching delay	0
1.19	Position gain switching time	0
2.22	Command smoothing filter	9.2
2.23	Command FIR filter	1.0

2. Enter Pr0.04 inertia ratio. Perform offline inertia identification or set to the calculated value by the debugging software.
The values in the following table are adjusted as standard values.

Sequence	Parameter No. (Pr)	Title of parameter	Standard value	Adjustment method
1	Pr1.01	1st speed loop gain	27	Increase this value within the range where no abnormal sound and vibration occur, therwise lower the value.
2	Pr1.04	1st torque filter	0.4	Try to change this value in case of vibration after changing Pr1.01. Make sure Pr1.01 * Pr1.04 shall be less than 100. To suppress the vibration after stop, increase Pr1.04 and decrease Pr1.01. Try to reduce Pr1.04 if the vibration at the moment of stop is too fierce.
3	Pr1.00	1st position loop gain	48	Adjust this by observing the positioning time. If the value is increased, the positioning time will be faster; if the value is too large, vibration will occur.
4	Pr1.02	1st velocity integral time constant	21	It is OK to set this value within range when there is no problem with the action. When the value is decreased, the positioning time becomes faster; if the value is too small, vibration will occur. When the set value is large, the deviation pulse will diverge. Increase in the range of no abnormal action and sound.
5	Pr1.10	Velocity feedforward gain	100	When the feedforward is set too large, with the occurrence of overshoot and the jitter of the positioning end signal, the setting time may not be shortened. The uneven command pulse input may be improved by increasing the set value of Pr1.11 (Velocity feedforward filter).

5.4.3 Adjustment of velocity control mode

The velocity control of ODSAP6 series servo is shown in the control block diagram of P.3.2.2-1.
Adjustment of the velocity control is roughly the same as the previous “Adjustment of position control mode”. Please adjust the parameters according to the procedures except for the setting of the position loop gain (Pr1.00, Pr1.05) and the setting of the speed feedforward gain (Pr1.10).

5.4.4 Adjustment of torque control mode

The torque control of ODSAP6 series servo is shown in the control block diagram of P.3.2.3-1.
Pr3.21: speed limit value 1, Pr3.22: speed limit value 2, torque control based on speed loop control. The setting of the speed limit values is described below.
1. Setting of speed limit value
According to the torque command selection (Pr3.17), the setting method is also different.
Pr3.17=0 set by speed limit value 1 (Pr3.21)
Pr3.17=1 set by analog input (SPL)
Pr3.17=2 for the positive direction – set by the speed limit value 1 (Pr3.21),

for the negative direction –set by the speed limit value 2 (Pr3.22)

・When the motor speed reaches the speed limit value, the torque control based on the analog torque command switch to the speed control based on the speed limit value command.

・To ensure stabilize action during the speed limit, you need to set the parameters according to the "Adjustment of velocity control mode" above.

・When the speed limit value is too low, the speed loop gain is too low or the speed loop integral time constant is 10000 (invalid), sometimes the torque cannot be output according to the analog torque command due to the smaller input of the torque limit.

・To control through torque command without the use of speed limit, the torque filter and notch filter are invalid and the velocity loop gain shall be set as high as possible at the maximum speed of the speed limit value.

5.4.5 Gain switching function

Gain switching based on internal data or external signals will achieve the following effects:

・Reduce the gain at stop process(servo lock) and suppress vibration.

・Increase the gain at stop process(setting) and shorten the setting time.

・Improve the gain at action and improve the command responsiveness.

・Gain switching with an external signal according to the machine state.

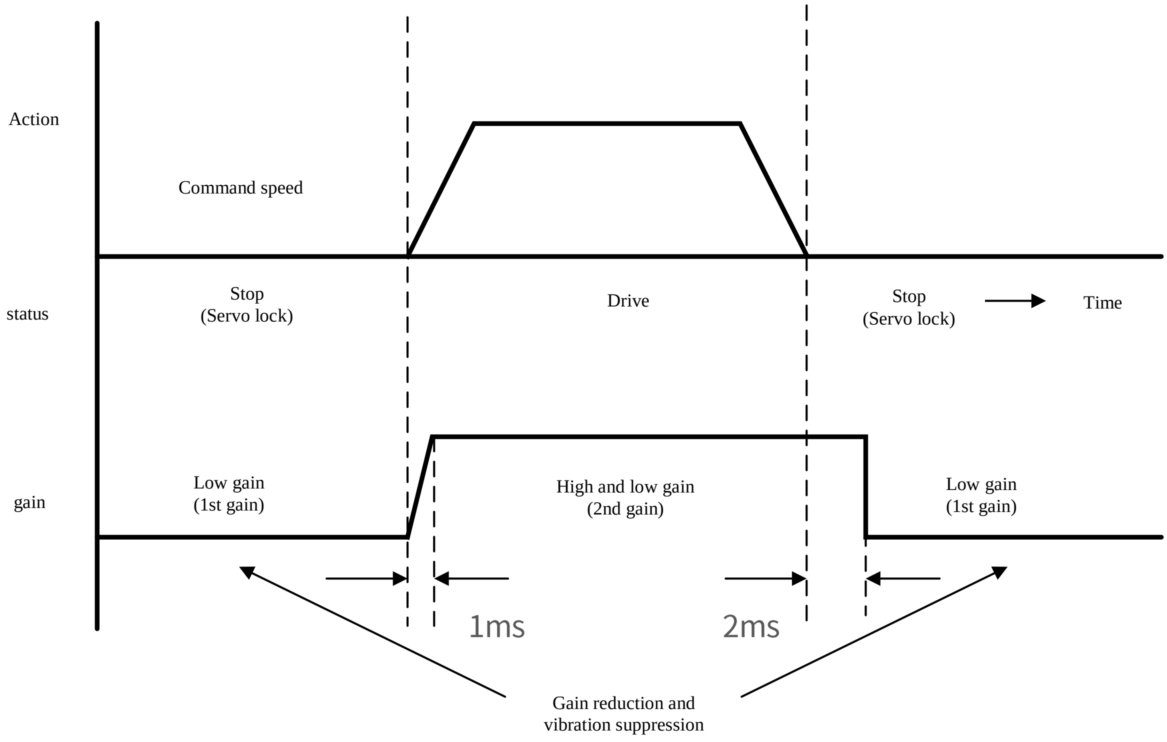


Figure 5.4.5-1 Gain switching sequence chart

＜Example＞

The gain can be switched to lower gain to reduce the abnormal noise in motor stop process(servo lock).

Parameter No.	Parameter name

Manual gain adjustment without gain ➡ Pr1.05-Pr1.09 (2nd gain) and Pr1.00-Pr1.04 (1st gain) set to the same value ➡ Set Pr1.14～Pr1.19 (gain switching condition) . ➡ Adjust (1st gain) Pr1.01 and Pr1.04 at stop.

		switching.			
1.00	1st position loop gain	63			
1.01	1st velocity loop gain	35			27
1.02	1st velocity integral time constant	16			
1.03	1st velocity detection filter	0			
1.04	1st torque filter	0.65			0.84
1.10	velocity feedforward gain	30			
1.11	velocity feedforward filter	0.5			
1.05	2nd position loop gain		63		
1.06	2nd velocity loop gain		35		
1.07	2nd velocity integral time constant		16		
1.08	2nd velocity detection filter		0		
1.09	2nd torque filter		0.65		
1.14	2nd gain setting	0		1	
1.15	Position control switching mode			7	
1.16	Position control switching delay time			30	
1.17	Position control switching level			0	
1.18	Position control switching hysteresis			0	
1.19	Position gain switching time			0	

0.04	Ratio of inertias	·Input value when load calculation is known. ·Automatically measure the inertia ratio by debugging software. ·Factory default 250.			

1. Setting of gain switching conditions

● Position control mode and full-closed loop control mode (○: parameter valid, －: invalid)

Setting of gain switching conditions			Parameters set in position control mode and full-closed loop control mode		
Pr1.15	2nd gain switching condition	Figure	Delay time *1	Grade	Hysteresis *2
			Pr1.16	Pr1.17	Pr1.18

0	1st gain fixed	-	-	-	-
1	2nd gain fixed	-	-	-	
2	Gain switching input	-	-	-	
3	Torque command	A	○	○〔%〕	○〔%〕
4	Invalid (1st gain fixed)		-	-	-
5	Speed command	C	○	○〔r/min〕	○〔r/min〕
6	Position deviation	D	○	○*3〔pulse〕	○*3〔pulse〕
7	Position command available	E	○	-	-
8	Positioning incomplete	F	○	-	-
9	Actual speed	C	○	○〔r/min〕	○〔r/min〕
10	Position command + actual speed	G	○	○〔r/min〕*5	○〔r/min〕*5

● Velocity control mode

Setting of gain switching conditions			Parameters set in speed control mode		
Pr1.20	2nd gain switching condition	Figure	Delay time*1	Grade	Hysteresis*2
			Pr1.16, 1.21	Pr1.17, 1.22	Pr1.18, 1.23
0	1st gain fixed		—	—	—
1	2nd gain fixed		—	—	—
2	Gain switching input		—	—	—
3	Torque command	A	○	○〔%〕	○〔%〕
4	Speed command variation	B	—	○*4〔10(r/min)/s〕	○*4〔10(r/min)/s〕
5	Speed command	C	○	○〔r/min〕	○〔r/min〕

● Torque control mode

Setting of gain switching conditions			Torque control mode setting parameters		
Pr1.24	2nd gain switching condition	Figure	Delay time*1	Grade	Hysteresis*2
			Pr1.16, 1.25	Pr1.17, 1.26	Pr1.18, 1.27
0	1st gain fixed		—	—	—
1	2nd gain fixed		—	—	—
2	Gain switching input GAIN on		—	—	—
3	Torque command	A	○	○〔%〕	○〔%〕

Note:
1. The delay time (PR1.16, 1.21, 1.25) is only valid when returning from the 2nd gain) to the 1st gain.
2. Hysteresis (PR1.18, 1.23, 1.27) is defined as shown in the figure below.
3. Specify the resolution of the encoder or external displacement sensor according to the control mode.
4. Please set the setting value to 1 when the speed change is 10r/min within 1s.
5. When Pr1.15 =10, the meanings of delay time, level and hysteresis are not the same as usual.

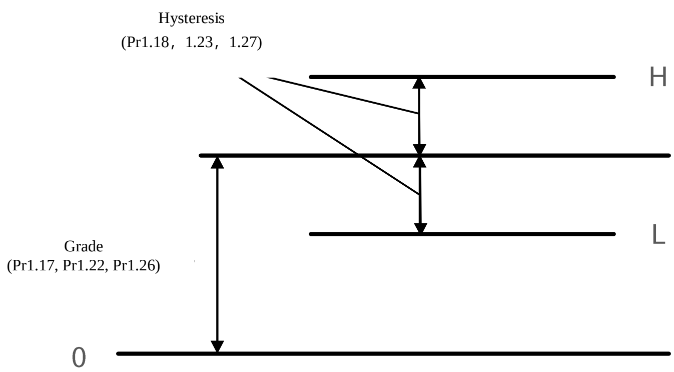


Figure 5.4.5-2 Definition of hysteresis

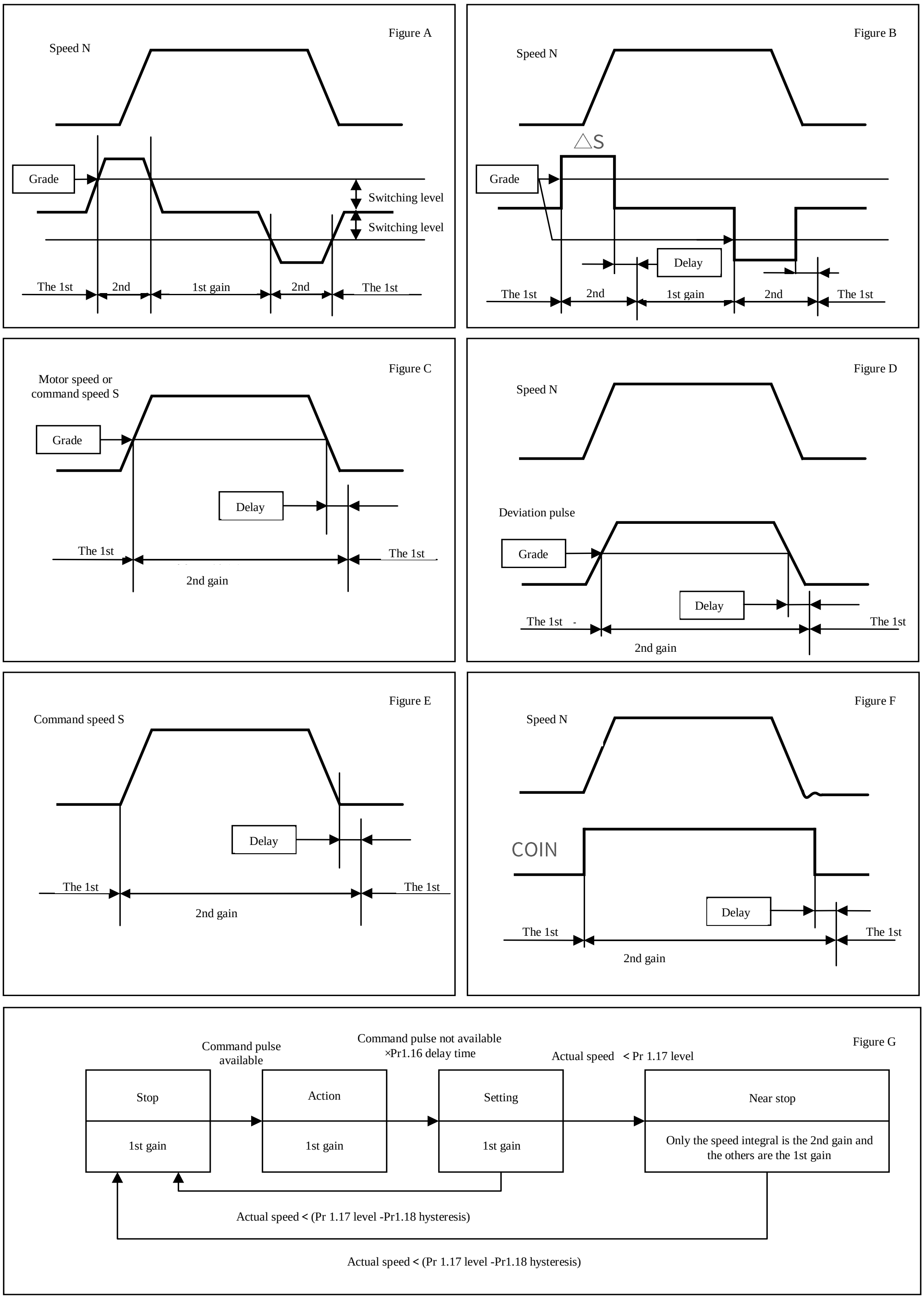


Figure 5.4.5-3 Gain switching sequence chart

Note: The figure above does not reflect the offset of gain switching sequence due to hysteresis (Pr1.18, 1.23, 1.27).

5.4.6 Mechanical resonance suppression

When the mechanical rigidity is low, vibration or abnormal sound may occur due to resonance caused by the axis distortion, and sometimes the gain value can not be improved. In this case, higher gain or lower vibration can be set by suppressing the resonance points with a notch filter.

1. Torque command filter (Pr1.04, 1.09)

Set the filter time constant to attenuate the gain near the resonance frequency.
The Cut-off frequency of the torque command filter can be calculated by the following formula.
Cut-off frequency (Hz) fc=1/(2π×parameter value ×0.00001)

2. Notch filter

● Adaptive filter (Pr2.00, Pr2.07～2.12)

The vibration caused by resonance can be controlled and automatically suppressed by using an adaptive filter. Set Pr2.00"Adaptive filter mode setting" to a parameter other than 0. When the resonance point affects the motor speed, the parameters of the third and the fourth notch filters will be automatically set according to the number of adaptive filters.

Pr2.00	Adaptive filter mode	1: 1 adaptive filter valid 2: 2 adaptive filters valid
Pr2.07	2nd notch frequency	Set to 5000 if no resonance point is found.
Pr2.08	Third notch width	Automatically set the when the adaptive filter is valid.
Pr2.09	Third notch depth	
Pr2.10	4th notch frequency	Automatically set the 2nd resonance frequency inferred by the adaptive filter. Set to 5000 if no resonance point is found.
Pr2.11	4th notch width	Automatically set when 2 adaptive filters are valid.
Pr2.12	4th notch depth	

● Notch filter (Pr2.01～2.12, 2.24～2.26)

With 5 notch filters, the parameters of frequency, width and depth can be adjusted manually.

Pr2.01	1st notch frequency	Set the center frequency of the 1st notch filter. *1
Pr2.02	1st notch width	Set the frequency width of the 1st notch filter.
Pr2.03	1st notch depth	Set the depth of the center frequency of the 1st notch filter.
Pr2.04	2nd notch frequency	Set the center frequency of the 2nd notch filter. *1
Pr2.05	2nd notch width	Set the frequency width of the 2nd notch filter.
Pr2.06	2nd notch depth	Set the depth of the center frequency of the 1st notch filter.
Pr2.07	2nd notch frequency	Set the center frequency of the 1st notch filter. *1
Pr2.08	Third notch width	Set the frequency width of the 3rd notch filter.
Pr2.09	Third notch depth	Set the depth of the center frequency of the 1st notch filter.
Pr2.10	4th notch frequency	Set the center frequency of the 1st notch filter. *1
Pr2.11	4th notch width	Set the frequency width of the 4th notch filter.
Pr2.12	4th notch depth	Set the depth of the center frequency of the 1st notch filter.
Pr2.24	5th notch frequency	Set the center frequency of the 1st notch filter. *1
Pr2.25	5th notch width	Set the frequency width of the 5th notch filter.
Pr2.26	5th notch depth	Set the depth of the center frequency of the 1st notch filter.

*1. When the set value is 5000, the notch filter is invalid.

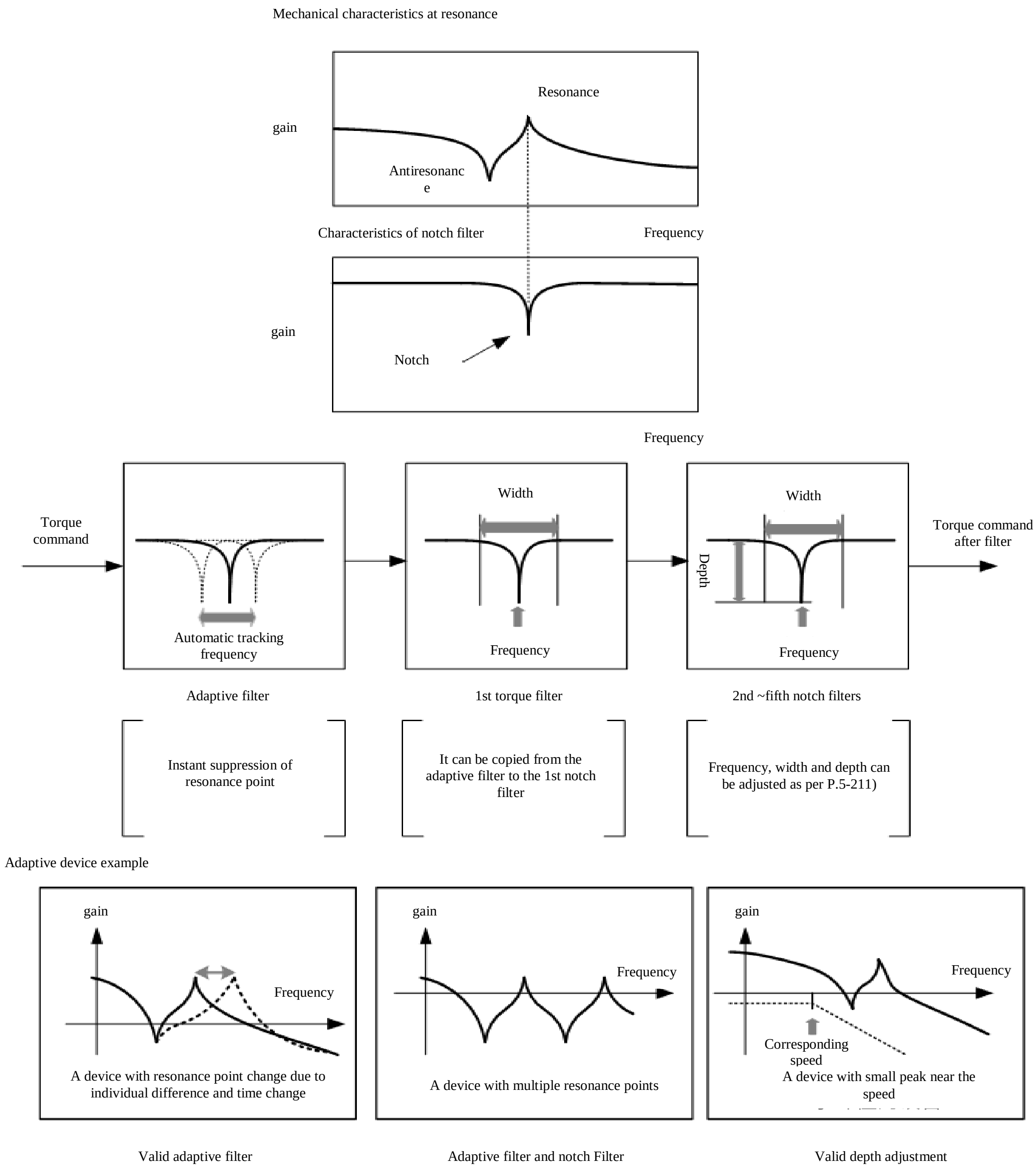


Figure 5.4.6-1 Filter action and example

3. About notch width and depth

The value in the left side of the following table is the ratio of the notch center frequency at a width and depth 0 of the notch filter to the frequency bandwidth at the attenuation rate －3［dB］.

The depth of the notch filter denotes the ratio of the input that completely cuts off the center frequency at a set value of 0 to the output and input that completely passes at a set value of 100. The values on the right side of the table below are formed when represented as [dB].

Notch width	Band width/center frequency
0	0.5
1	0.59
2	0.71
3	0.84

Notch depth	Input/output ratio	［dB］ Representation
0	0	－∞
1	0.01	-40
2	0.02	-34
3	0.03	-30.5

4	1
5	1.19
6	1.41
7	1.68
8	2
9	2.38
10	2.83
11	3.36
12	4
13	4.76
14	5.66
15	6.73
16	8
17	9.51
18	11.31
19	13.45
20	16

4	0.04	-28
5	0.05	-26
6	0.06	-24.4
7	0.07	-23.1
8	0.08	-21.9
9	0.09	-20.9
10	0.1	-20
15	0.15	-16.5
20	0.2	-14
25	0.25	-12
30	0.3	-10.5
35	0.35	-9.1
40	0.4	-8
45	0.45	-6.9
50	0.5	-6
60	0.6	-4.4
70	0.7	-3.1
80	0.8	-1.9
90	0.9	-0.9
100	1	0

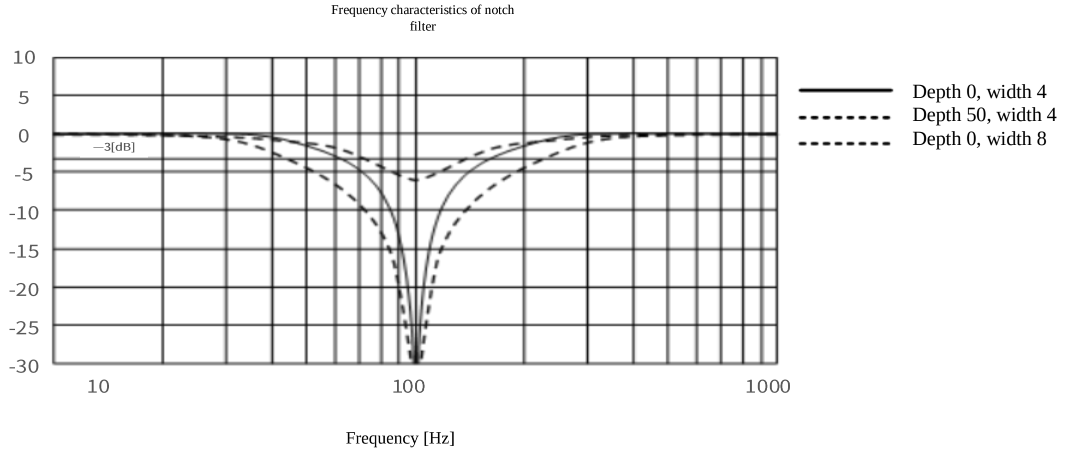


Figure 5.4.6-2 Frequency characteristics of notch filter

4. Relationship between gain adjustment and mechanical rigidity
To improve mechanical rigidity
(1) The machine shall be placed on the ground fixedly to avoid shaking.
(2) Use servo couplings with high rigidity.
(3) Use a wide synchronous belt. In addition, the tension shall be set within the allowable axial overload range of the motor.
(4) Use gears with small back clearance.
The natural vibration (resonance frequency) of the machine will greatly affect the gain adjustment of the servo machine.
For a machine with low resonance frequency (= low mechanical rigidity), the responsiveness of the servo system cannot be set high.
Note: Contact relevant personnel of the company for the installation and debugging software “Ω Master”.

5.5Manual gain adjustment (advanced)

5.5.1 Vibration control

The shaking of the mechanical device during operation, or the jitter at the end of the machine after running to a specified position may affect the equipment performance in some industrial applications. In view of the vibration at the end of the device and the overall shaking of the device, it is necessary to eliminate the vibration frequency component from the position command so as to reduce vibration. The product provides a 4-way vibration control filter that can suppress 4 frequency points simultaneously.

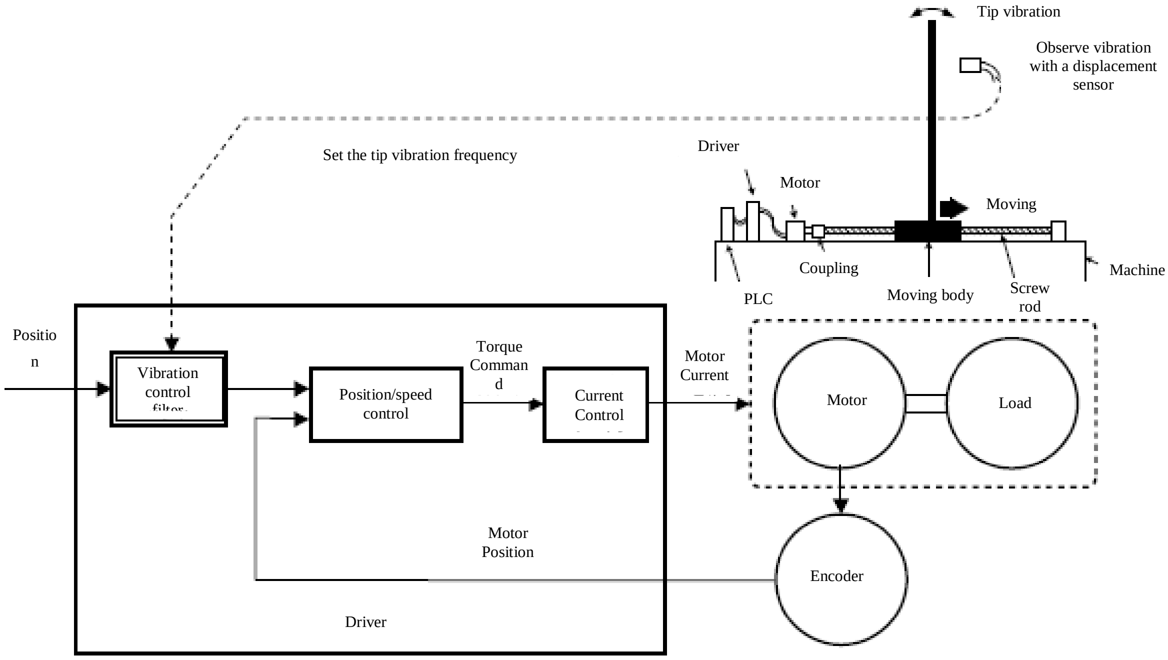


Figure 5.5.1-1 Vibration control block diagram

Scope of application
This function is not available if the following conditions are not met

	Vibration control operation conditions
Control mode	・Position control or full-closed loop control Pr0.01=0: position control Pr0.01=3: 1st control mode of position ・ velocity control Pr0.01=4: 1st control mode of position ・ torque control Pr0.01=6: full-closed loop control

Precautions
Under the following conditions, the motor can not act normally sometimes, or vibration control effect is not obvious

	Factors affecting the effect of vibration control
Load	・Vibration caused by a reason other than the command (external force, etc.). ・When the ratio of the resonance frequency to the antiresonance frequency is large. ・When the vibration frequency is outside the range of 1 ~ 300[Hz].

Usage
1. Vibration control frequency setting (Pr2.14, Pr2.16, Pr2.18, Pr2.20)
Measure the vibration frequency at the end of the device. Use a laser locator for direct measurement, read the vibration frequency (Hz) from the measured waveform, and input the vibration control frequency parameters.

When no measuring instrument is available, the oscilloscope function of the debugging software of the servo upper computer is used, as shown below, to read the vibration frequency (HZ) according to the position deviation waveform for setting.

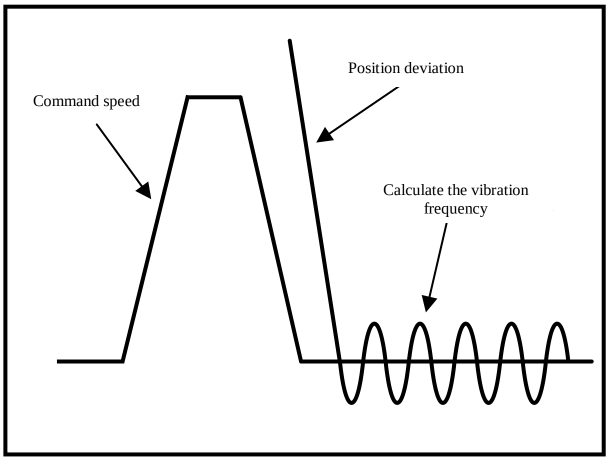


Figure 5.5.1-2 Measurement of vibration control frequency

2. Vibration control damping coefficient setting (Pr2.15, Pr2.17, Pr2.19, Pr2.21): the damping coefficient of vibration control is set within the range of 0-1. The smaller the value is, the stronger the action is.

3. Vibration control filter switching selection (Pr2.13): switch the 1st ~ fourth vibration control filters according to the actual requirements

Pr2.13	VS-SEL1	VS-SEL2	1st vibration control	2nd vibration control	3rd vibration control	4th vibration control
0	-	-	O	O		
1	-	OFF	O		O	
	-	ON		O		O
2	OFF	OFF	O			
	OFF	ON		O		
	ON	OFF			O	
	ON	ON				O

Pr2.13	Position command direction	1st vibration control	2nd vibration control	3rd vibration control	4th vibration control
3	Positive direction	O		O	
	Negative direction		O		O

Note: Switching of vibration control is performed when the command pulse is switched from 0 state to non-0 every (0.1ms) during the positioning completion output.

In particular, if the positioning completion range is too large in the high vibration control frequency or in case of invalidation, the cumulative pulse remains in the filter at the above time and the motor will quickly return to the homeal position after switching, so the motor speed may be higher than the previous command speed.

5.5.2 Feedforward function

1. Summary

The velocity feedforward is added by the velocity control command required for the action from the internal position command and the speed command calculated through the comparison with the position feedback in the position control and full-closed loop control mode. Compared with the feedback control, the velocity feedforward can better reduce position deviation and improve responsiveness.

In addition, the torque feedforward is added by the torque command required for the action from the velocity control command and the torque command calculated through the comparison with the position feedback can improve the response of the speed control system.

Correlation parameters

Velocity feedforward and torque feedforward are used.

classification	No.	Parameter name	Function
1	10	Velocity feedforward gain	The ratio of this parameter multiplied by the velocity control command calculated from the internal position command is added to the speed command in the position control processing.
1	11	Velocity feedforward filter	Set the time constant of primary delay filter required for the velocity feedforward input.
1	12	Torque feedforward gain	The ratio of this parameter multiplied by the torque command calculated from the velocity control command is added to the torque command in the speed control processing.
1	13	Torque feedforward filter	Set the time constant of primary delay filter required for the torque feedforward input.
6	0	Analog torque feedforward conversion gain	Set the input gain of the analog torque feedforward. 0～9 is invalid.
6	10	Function extension setting	Set the relevant bit of the analog torque feedforward. bit5 0: analog torque FF invalid 1: analog torque FF valid * the lowest bit is bit0.

Example of velocity feedforward

The velocity feedforward is valid by gradually increasing the velocity feedforward gain. At a certain speed, the position deviation in action can be used to reduce the value of the speed feedforward gain according to the following formula.

Position deviation [command unit]= command speed [command unit /s]/ position loop gain [1/s] ×(100 - Speed feedforward gain [%])/100

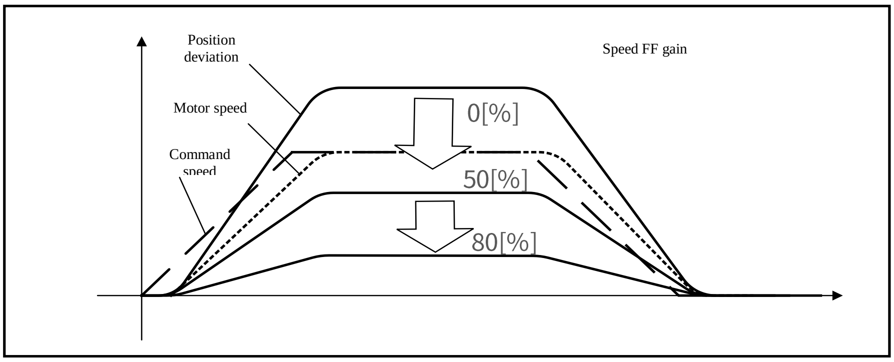


Figure 5.5.2-1 Speed feedforward effect rendering

If the feedforward gain is set to 100%, the position deviation is calculated to be zero, but there will be a huge overshoot during acceleration and deceleration.

In addition, when the update cycle of the position command input is longer than the control update cycle of the driver, or when the pulse frequency is unequal, the working sound may become louder when the velocity feedforward is valid. In this case, use the position command filter (one delay /FIR smoothing), or increase the value of the velocity feedforward filter.

Example of torque feedforward

The use of torque feedforward requires the correct setting of the inertia ratio.

When the torque feedforward filter is set to about 0.5 ms, the torque feedforward becomes valid by gradually increasing the torque feedforward gain.

If the torque feedforward gain is increased, the position deviation of fixed acceleration and deceleration can be close to 0. Therefore, under ideal conditions without interference torque,

the position deviation of all the action regions is approximately close to 0 when driven by trapezoidal speed model.

In fact, the interference torque certainly exists, so the position deviation cannot be completely changed to 0.

In addition, just like the speed feedforward, although the larger the time constant of the torque feedforward filter is and the smaller the action sound will be, the larger the position deviation of the acceleration change point will be.

5.5.3 Third gain switching function

Overview

In addition to the usual gain switching function as shown in P.5-30, the third gain switching during stop process can also be set to increase the gain during the stop process for a specified period of time, which can shorten the positioning and setting time.

Scope of application

This function is not available if the following conditions are not met

	Action condition for third gain switching function
Control mode	・Position control or full-closed loop control Pr0.01=0: position control Pr0.01=3: 1st control mode of position ・ velocity control Pr0.01=4: 1st control mode of position ・ torque control Pr0.01=6: full-closed loop control
Other	・Enable the servo. ・Set the deviation counter clear command input inhibiting, torque limit and conditions other than control parameters properly. The motor shall be in normal rotation without fault.

Correlation parameters

classification	No.	Parameter name	Function
6	5	Valid time of third position gain	Set the valid time of the third gain.
6	6	Third position gain ratio	Set the third gain with the ratio for 1st gain. Third gain=1st gain ×Pr6.06/100

Usage

Under the normal operation of the gain switching function, set the applicable time of the third gain in Pr6.05" Position third gain valid time" and set the ratio of the third gain against the 1st gain in Pr6.06" Position third gain ratio".

・ Set Pr6.05=0 and Pr6.06=100 if the third gain is not used.

・The third gain is valid only in the position control/full-closed loop control.

・ Only the position loop gain/velocity loop gain is the third gain at the third gain interval and the others apply to the 1st gain setting.

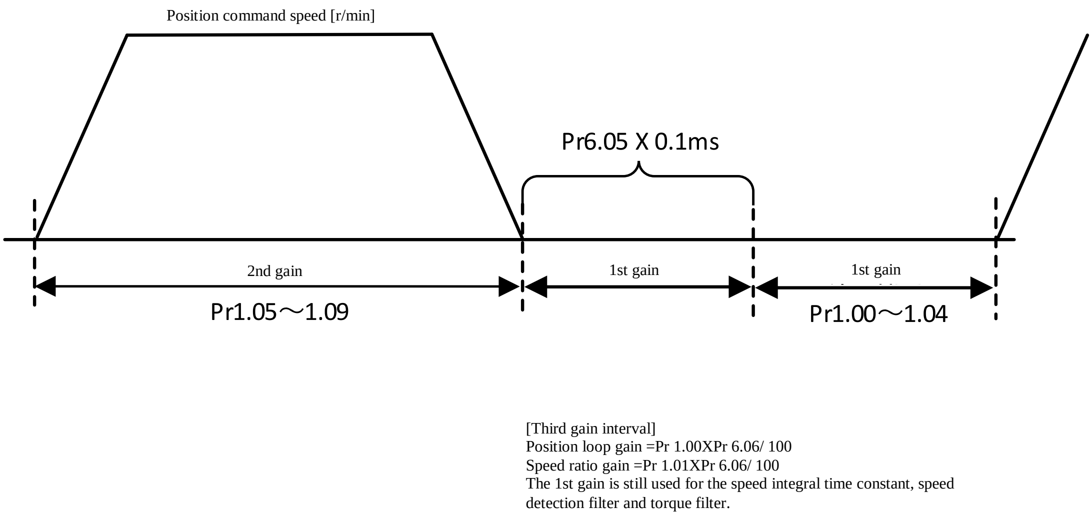
・ Switch to the 2nd gain when the 2nd gain switching condition is established in the third gain interval.

・ Pr1.19" Position gain switching time" applies to switching from the 2nd gain to the third gain.

Caution

Note that the third gain interval will also generate when switching the 2nd gain to the 1st gain in case of parameter change.

Example) Pr1.15" Position control switching mode" =7 switching condition: position command available



5.5.4 Inertia ratio switching function

Overview
According to the inertia ratio switching input (J-SEL), the 1st/2nd inertia switching ratio can be used when the load inertia has two stages of change. The scope of application applies to this function only the following conditions are met.

	Action condition for inertia ratio switching function
Control mode	・Available in all control modes. Pr0.01=0: position control Pr0.01=1: velocity control Pr0.01=2: torque control Pr0.01=3: position ・ velocity control Pr0.01=4: position ・ torque control Pr0.01=5: velocity ・ torque control Pr0.01=6: full-closed loop control
Other	・ Enable the servo. ・ Set the deviation counter clear command input inhibiting, torque limit and conditions other than control parameters properly The motor shall be in normal rotation without fault. ・ When the teal-time automatic adjustment is invalid. (Pr0.02=0) ・ When the adaptive filter is invalid. (Pr2.00=0) ・ When the load change inhibiting function is invalid. (Pr6.24 bit1=0)

Precautions
・ Be sure to switch the inertia ratio when the motor is stopped. Switching during motor action will lead to vibration and oscillation.
・ When the difference between the 1st inertia ratio and the 2nd inertia ratio is large, vibration will occur, etc., even when the motor stops. Please make sure that the vibration will not cause problems before use
.
Correlation parameters
Set the inertia ratio switching function combined with the following three parameters

classification	No.	Parameter name	Function

6	10	Function extension setting	Set the relevant bit of inertia ratio switching function. bit3 0: inertia ratio switching invalid 1: valid * The least significant bit is bit0. Example) When the inertia ratio switching is valid Set value =8
0	04	Ratio of inertias	Set the 2nd inertia ratio. Set the ratio of load inertia to the rotor inertia of the motor.
6	13	2nd inertia ratio	Set the 2nd inertia ratio. Set the ratio of load inertia to the rotor inertia of the motor.

Usage

Switch between the 1st inertia ratio and the 2nd inertia ratio through the inertia ratio switching input (J-SEL).

Inertia ratio switching input (J-SEL)	Applicable inertia ratio
OFF	1st inertia ratio (Pr0.04)
ON	1st inertia ratio (Pr6.13)

5.6 **Homing Function**

In some special occasions, the servo motor needs to return to the home position by itself. Ω6 series provides customers with 38 kinds of homing modes to meet different field application needs.

In different homing modes, customers can directly find the phase Z (index) signal of the servo motor according to the field application; or find the mechanical (left/right) limit (Switch) and home signal, and then the phase Z (index) signal of the servo motor; or only find the mechanical (left/right /) limit (Switch) and home signal for mechanical zero point positioning.

[Note] When using the homing function, the corresponding I/O signal shall be connected to the driver. If I/O homing is required, the corresponding input port function shall be set to "homing function enabled" and the output port function shall be set to "Homing complete output". When the "Homing function enabled" signal is received, homing is enabled and then "Homing complete output" is output.

There are two homing speeds: deceleration signal search speed and home signal search speed. The former can be set to a high value to prevent homing exception alarm caused by long homing time; the latter can be set to a low value to prevent large deviation between the stop position and the set mechanical home position caused by servo overshoot at high-speed stop.

5.6.1 Homing configuration process

The upper computer 1st changes Pr5.04 driver inhibiting input setting to valid; configures corresponding IO NOT　POT to normally on; selects the homing mode, sets the 1st homing speed(fast speed),2nd homing speed(slow speed),homing acceleration and homing offset; enables servo enable homing, and the servo will completes homing according to the set automatic mechanical home.

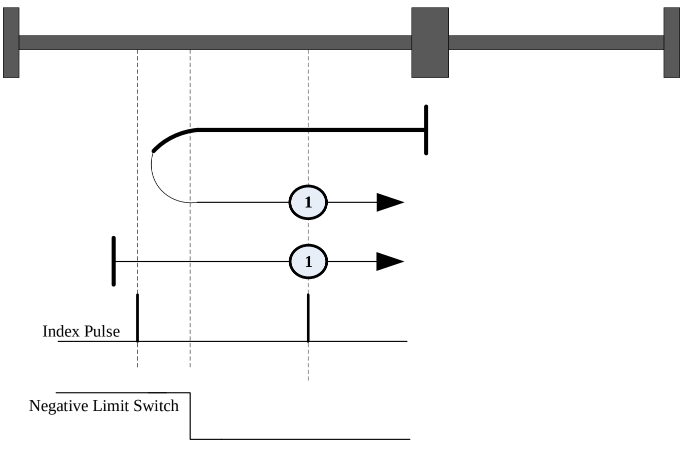
5.6.2 **Homing Functional description**

Homing method 0: Homing parameter clear

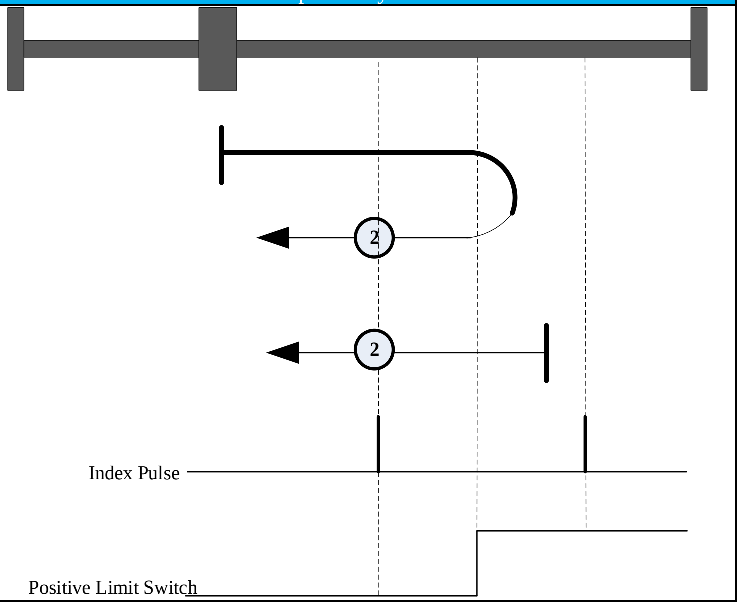
Description	Explanatory chart

Homing method 1 :Homing on negative limit switch and index pluse

Signal: negative limit and index signal

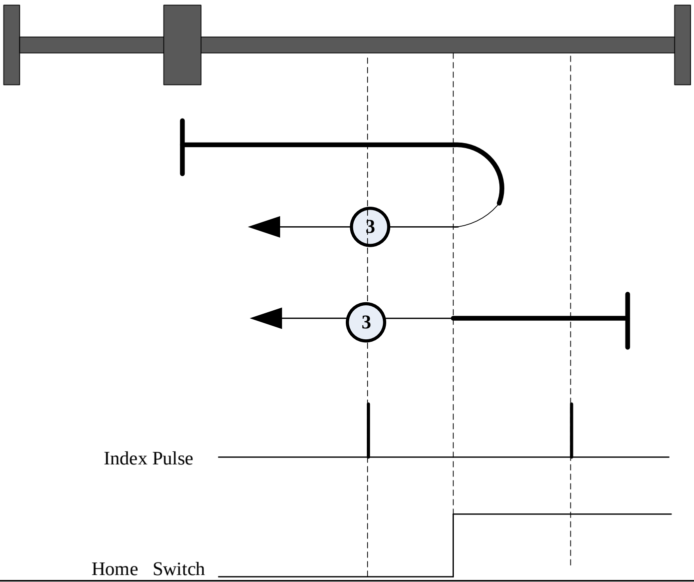
Description	Explanatory chart
Case 1: The load is not in the negative limit switch position Homing steps: 1. Run to the negative limit switch in the negative direction and decelerate and stop; 2. Find the 1st Index signal from the positive limit switch in the positive direction after negative limit to decelerate and stop; 3. Run to the Index position and set this position as zero. Case 2: The load is in the negative limit switch position 1. Find the 1st Index signal from the positive limit switch in the positive direction to decelerate and stop; 2. Run to the Index position and set this position as zero.	

Homing method 2 :Homing on positive limit switch and index pluse
Signal: positive limit and index signal

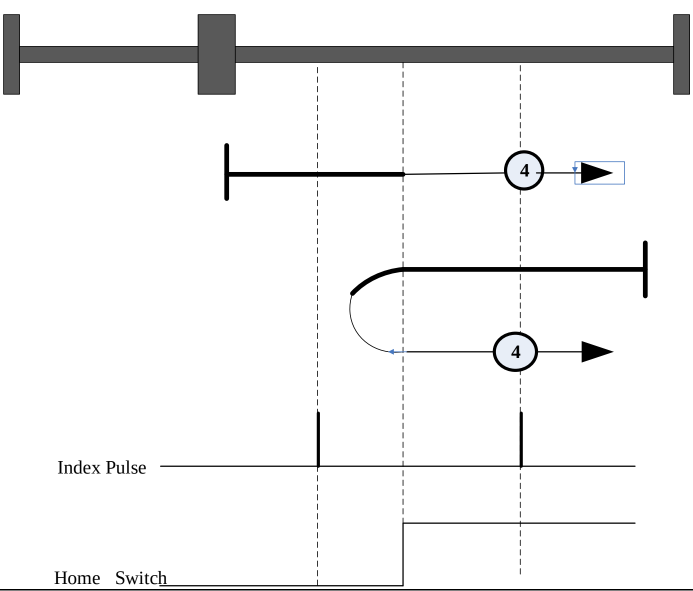
Description	Explanatory chart
Case 1: The load is not in the positive limit switch position Homing steps: 1. Run to the positive limit switch in the positive direction and decelerate and stop; 2. Find the 1st Index signal from the positive limit switch in the negative direction after positive limit to decelerate and stop; 3. Run to the Index position and set this position as zero. Case 1: The load is not in the positive limit switch position 1. Find the 1st Index signal from the positive limit switch in the negative direction to decelerate and stop; 2. Run to the Index position and set this position as zero.	

oming method 3 :Homing on positive home switch and index pluse (leave home switch)

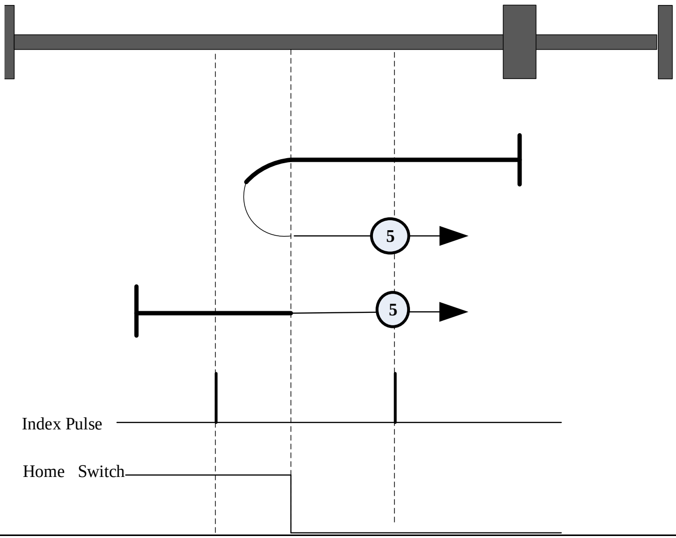
Signal: home switch and index signal

Description	Explanatory chart
As shown in the figure, there are two cases for this mode: **Case 1**: The load is not in the positive home switch position Homing steps: 1. Run to the home switch in the positive direction and decelerate and stop; 2. Run in the negative direction and leave the home switch and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the positive home switch position Homing steps: 1. Run in the negative direction and leave the home switch and decelerate and stop in the 1st Index signal; 2. Run to the Index position and set this position as zero.	

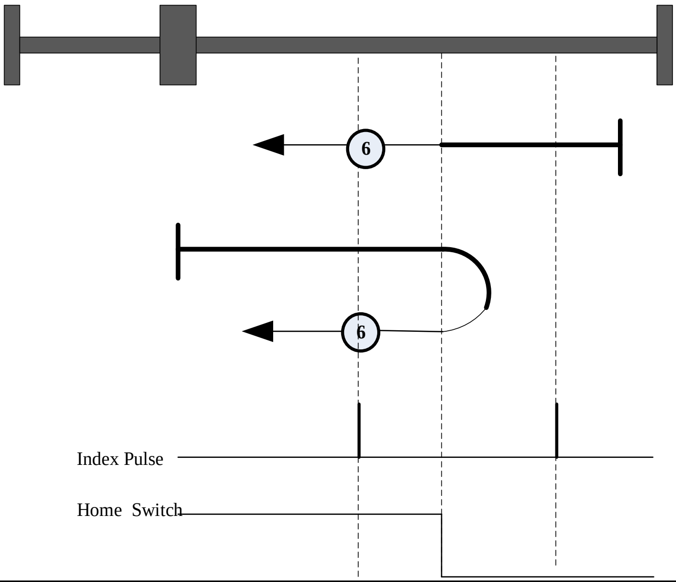
Homing method 4 :Homing on positive home switch and index pluse (touch home switch)
Signal: home switch and index signal

Description	Explanatory chart
As shown in the figure, there are two cases for this mode: **Case 1:** The load is not in the positive home switch position Homing steps: 1. Run to the home switch in the positive direction and decelerate and stop; 2. Run in the positive direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the positive home switch position Homing steps: 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Run to the home switch in the positive direction and continue to run to the 1st Index signal before deceleration and stop; 3. Run to the Index position and set this position as zero.	

Homing method 5 :Homing on negative home switch and index pluse (leave home switch)
Signal: home switch and index signal

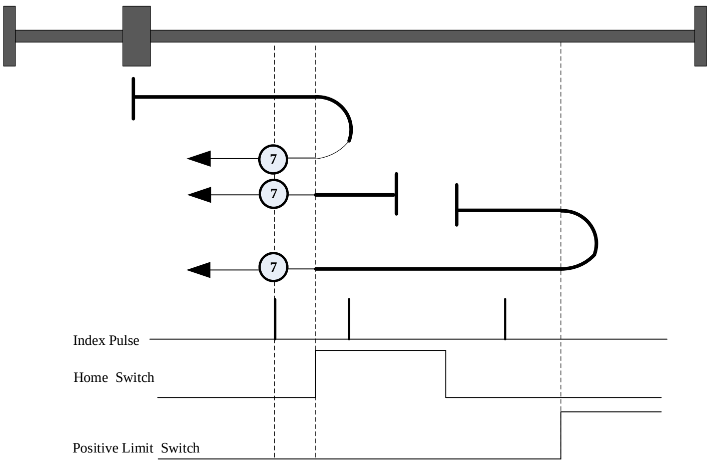
Description	Explanatory chart
As shown in the figure, there are two cases for this mode: **Case 1:** The load is not in the negative home switch position Homing steps: 1. Run to the home switch in the negative direction and then decelerate and stop; 2. Run in the negative direction and leave the home switch, decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the negative home switch position Homing steps: 1. Run in the negative direction and leave the home switch, decelerate and stop in the 1st Index signal; 2. Run to the Index position and set this position as zero.	

Homing method 6 :Homing on negative home switch and index pluse (touch home switch)
Signal: home switch and index signal

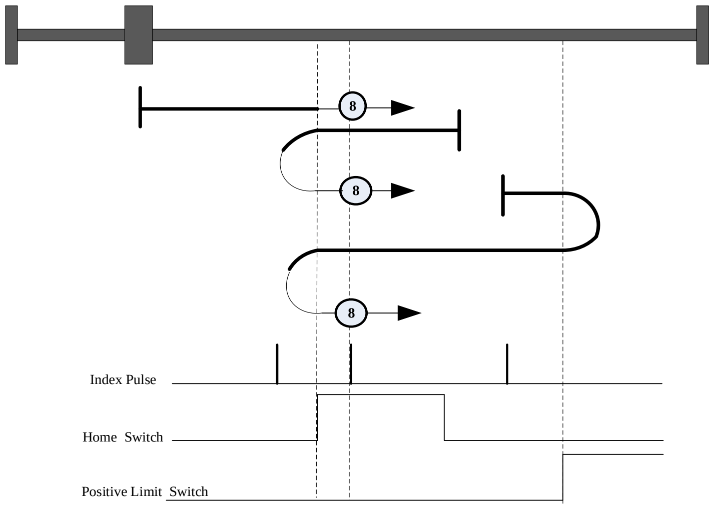
Description	Explanatory chart
As shown in the figure, there are two cases for this mode: **Case 1:** The load is not in the negative home switch position Homing steps: 1. Run to the home switch in the negative direction and then decelerate and stop; 2. Run in the negative direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the negative home switch position Homing steps: 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Run to the home switch in the negative direction and continue to run to the 1st Index signal before deceleration and stop; 3. Run to the Index position and set this position as zero.	

Homing method 7: Homing on positive limit switch , homing on positive home switch and index pulse (leave the negative edge of home switch)

Signal: positive limit, home switch and index signal

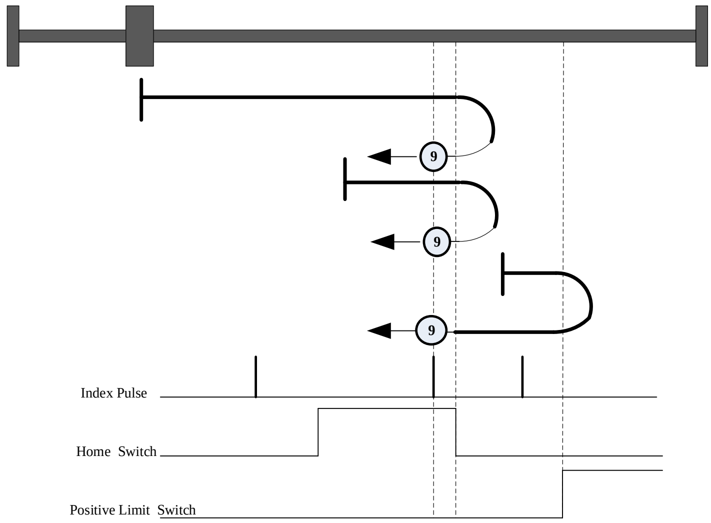
Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1:** The load is in the negative home switch position 1. Run to the home switch in the positive direction and decelerate and stop; 2. Leave the home switch in the negative direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop in the 1st Index signal in the negative direction; 2. Run to the Index position and set this position as zero. **Case 3:** The load is in the positive home switch position 1. Run to the positive limit switch in the positive direction and decelerate and stop; 2. Run in the negative direction and leave the home switch and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero.	

Homing method 8: Homing on positive limit switch , homing on positive home switch and index pulse (touch the negative edge of home switch)
Signal: positive limit, home switch and index signal

Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1:** The load is in the negative home switch position 1. Run to the home switch in the positive direction and decelerate and stop; 2. Run in the positive direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Run in the positive direction to the home switch and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 3:** The load is in the positive home switch position 1. Run to the positive limit switch in the positive direction and decelerate and stop; 2. Run in the negative direction and leave the home switch before deceleration and stop; 3. Run in the positive direction to the home switch and decelerate and stop in the 1st Index signal; 4. Run to the Index position and set this position as zero.	

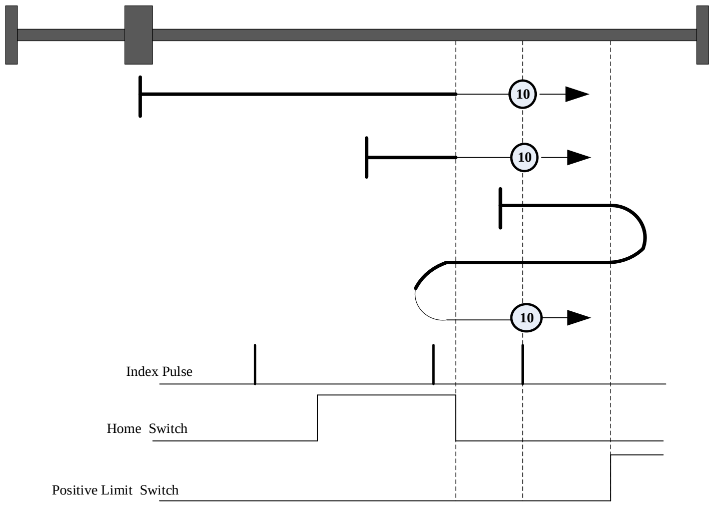
Homing method 9: Homing on positive limit switch , homing on negative home switch and index pulse (touch the positive edge of home switch)

Signal: positive limit, home switch and index signal

Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1:** The load is in the negative home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Run in the positive direction to the home switch and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Run in the positive direction to the home switch and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 3:** The load is in the positive home switch position 1. Run in the positive direction to the positive limit switch and run in the negative direction to the home switch before deceleration and stop; 2. Run in the negative direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero.	

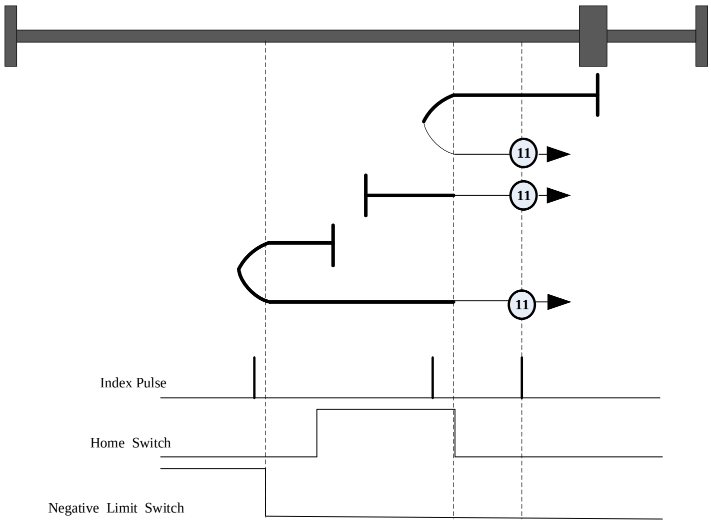
Homing method 10: Homing on positive limit switch , homing on negative home switch and index pulse (leave the positive edge of home switch)

Signal: positive limit, home switch and index signal

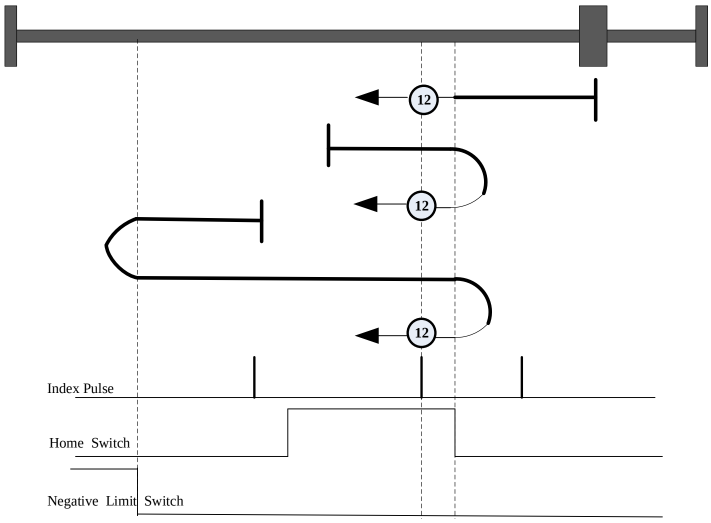
Description	Explanatory chart
As shown in the figure, there are three cases for this mode: Case 1: The load is in the negative home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Run in the positive direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. Case 2: The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Run in the positive direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. Case 3: The load is in the positive home switch position 1. Run to the positive limit switch in the positive direction and decelerate and stop; 2. Run to the home switch in the negative direction and decelerate and stop; 3. Run in the negative direction and leave the home switch, decelerate and stop in the 1st Index signal; 4. Run to the Index position and set this position as zero.	

Homing method 11: Homing on negative limit switch , homing on positive home switch and index pulse (leave the positive edge of home switch)

Signal: negative limit, home switch and index signal

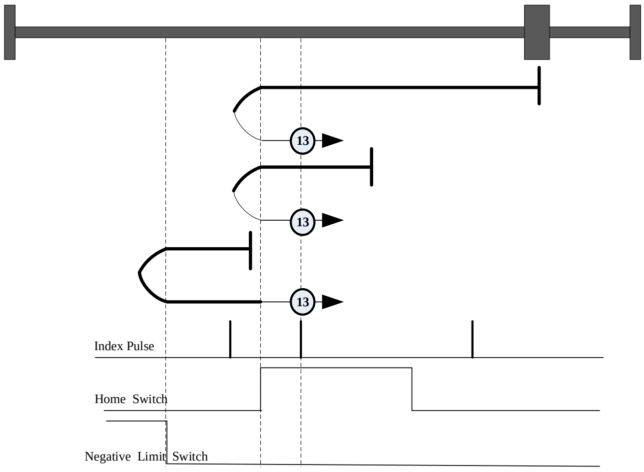
Description	Explanatory chart
As shown in the figure, there are three cases for this mode: Case 1: The load is in the positive home switch position 1. Run to the home switch in the negative direction and then decelerate and stop; 2. Leave the home switch in the positive direction, decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. Case 2: The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop in the 1st Index signal in the positive direction; 2. Run to the Index position and set this position as zero. Case 3: The load is in the negative home switch position 1. Run to the negative limit switch in the negative direction and decelerate and stop; 2. Run in the negative direction and leave the home switch, decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero.	

Homing method 12: Homing on negative limit switch , homing on positive home switch and index pulse (touch the positive edge of home switch)
Signal: negative limit, home switch and index signal

Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1**: The load is in the positive home switch position 1. Run to the home switch in the negative direction and decelerate and stop; 2. Run in the negative direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Contact the home switch in the negative direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 3:** The load is in the negative home switch position 1. Run to the negative limit switch in the negative direction and decelerate and stop; 2. Run in the positive direction and leave the home switch before deceleration and stop; 3. Run in the negative direction to the home switch and decelerate and stop in the 1st Index signal; 4. Run to the Index position and set this position as zero.	

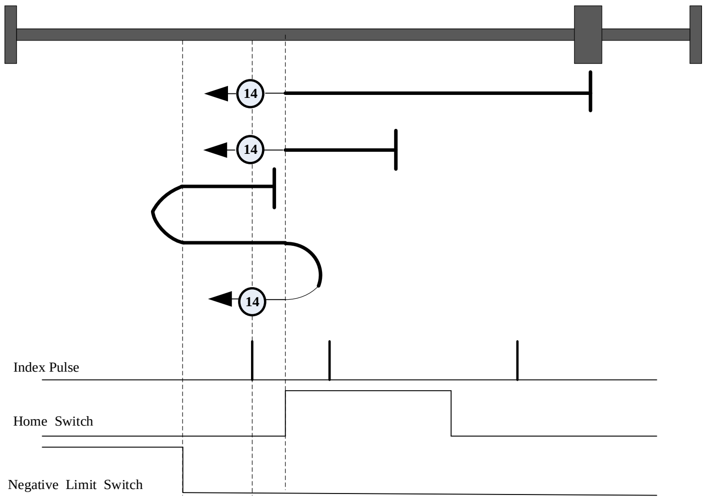
Homing method 13: Homing on negative limit switch , homing on negative home switch and index pulse (touch the negative edge of home switch)

Signal: negative limit, home switch and index signal

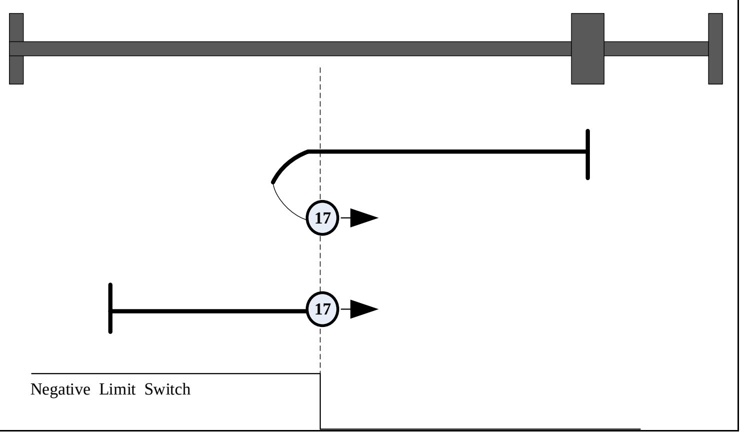
Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1**: The load is in the positive home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Run in the positive direction to the home switch and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Run in the positive direction to the home switch and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 3:** The load is in the negative home switch position 1. Run in the negative direction to the negative limit switch and run in the positive direction to the home switch before deceleration and stop; 2. Run in the positive direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero.	

Homing method 14: Homing on negative limit switch , homing on negative home switch and index pulse (leave the negative edge of home switch)

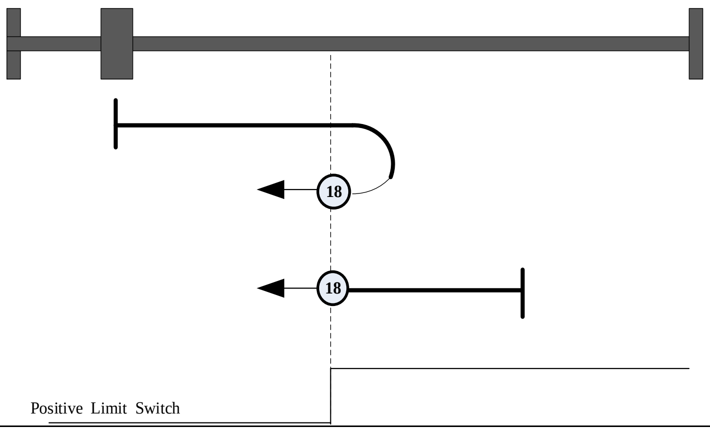
Signal: negative limit, home switch and index signal

Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1**: The load is in the positive home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Run in the negative direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Run in the negative direction and decelerate and stop in the 1st Index signal; 3. Run to the Index position and set this position as zero. **Case 3:** The load is in the negative home switch position 1. Run to the negative limit switch in the negative direction and decelerate and stop; 2. Run to the home switch in the positive direction and decelerate and stop; 3. Run in the negative direction and leave the home switch and decelerate and stop in the 1st Index signal; 4. Run to the Index position and set this position as zero.	

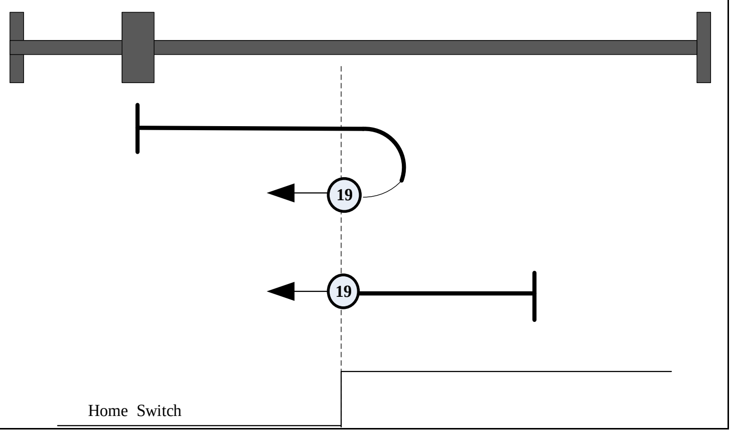
Homing method 15: reserved
Homing method 16: reserved
Homing method 17:Homing on negative limit switch(falling edge of limit switch)
Signal: negative limit

Description	Explanatory chart
As shown in the figure, there are two cases for this mode: Case 1: The load is not in the negative limit switch position 1. Run to the negative limit switch in the negative direction and decelerate and stop; 2. Run in the positive direction and leave the limit switch before deceleration and stop; 3. Set this position as zero. Case 2: The load is in the negative limit switch position 1. Run in the positive direction and leave the limit switch before deceleration and stop; 2. Set this position as zero.	

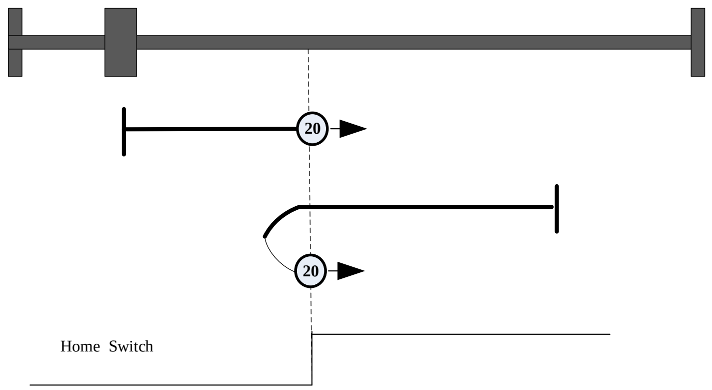
Homing method 18:Homing on positive limit switch(falling edge of limit switch)
Signal: positive limit

Description	Explanatory chart
As shown in the figure, there are two cases for this mode: Case 1: The load is not in the positive limit switch position 1. Run to the positive limit switch in the positive direction and decelerate and stop; 2. Run in the negative direction and leave the limit switch before deceleration and stop; 3. Set this position as zero. Case 1: The load is not in the positive limit switch position 1. Run in the negative direction and leave the limit switch before deceleration and stop; 2. Set this position as zero.	

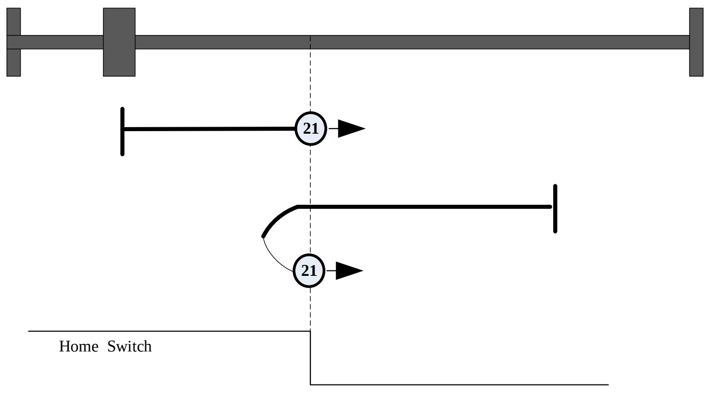
Homing method 19:Homing on positive home switch(falling edge of home switch)
Signal: home switch

Description	Explanatory chart
As shown in the figure, there are two cases for this mode: **Case 1:** The load is not in the home switch position 1. Run to the home switch in the positive direction and decelerate and stop; 2. Run in the negative direction and leave the home switch before deceleration and stop; 3. Set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Set this position as zero.	

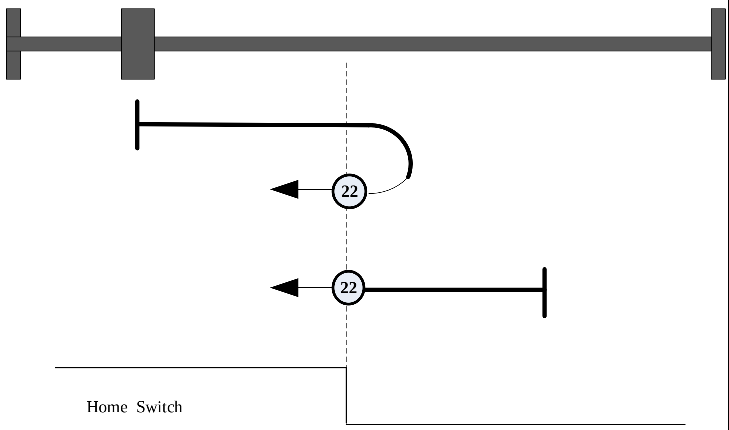
Homing method 20:Homing on positive home switch(rising edge of home switch)
Signal: home switch

Description	Explanatory chart
As shown in the figure, there are two cases for this mode: **Case 1:** The load is not in the home switch position 1. Run to the home switch in the positive direction and decelerate and stop; 2. Set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Run to the home switch in the positive direction and decelerate and stop; 3. Set this position as zero.	

Homing method 21:Homing on negative home switch(falling edge of home switch)
Signal: home switch

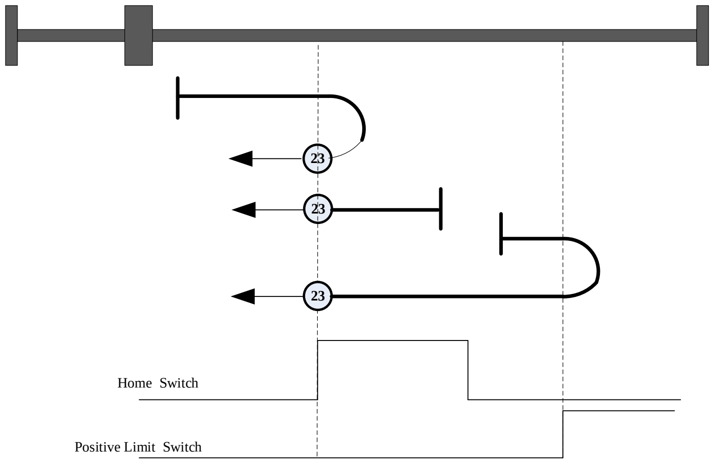
Description	Explanatory chart
As shown in the figure, there are two cases for this mode: Case 1: The load is not in the home switch position 1. Run to the home switch in the negative direction and decelerate and stop; 2. Run in the positive direction and leave the home switch before deceleration and stop; 3. Set this position as zero. Case 2: The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Set this position as zero.	

Homing method 22:Homing on negative home switch(rising edge of home switch)
Signal: home switch

Description	Explanatory chart
As shown in the figure, there are two cases for this mode: **Case 1:** The load is not in the home switch position 1. Run to the home switch in the negative direction and decelerate and stop; 2. Set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Run to the home switch in the negative direction and decelerate and stop; 3. Set this position as zero.	

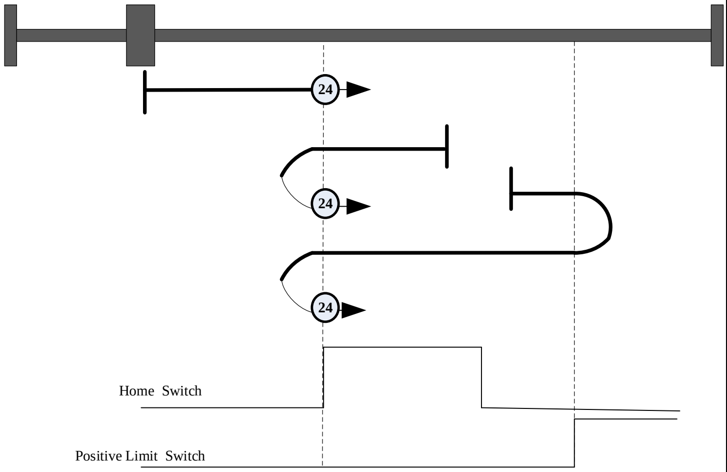
Homing method 23: Homing on positive limit switch and homing on positive home switch(falling edge of home switch)

Signal: home switch and positive limit

<table>
<tr><th>Description</th><th>Explanatory chart</th></tr>
<tr><td>As shown in the figure, there are three cases for this mode:
Case 1: The load is in the negative home switch position
1. Run to the home switch in the positive direction and decelerate and stop;
2. Run in the negative direction and leave the home switch before deceleration and stop;
3. Set this position as zero.
Case 2: The load is in the home switch position
1. Run in the negative direction and leave the home switch before deceleration and stop;
2. Set this position as zero.
Case 3: The load is in the positive home switch position
1. Run to the positive limit switch in the positive direction and decelerate and stop;
2. Run in the negative direction and leave the home switch before deceleration and stop;
3. Set this position as zero.</td><td>
</td></tr>
</table>

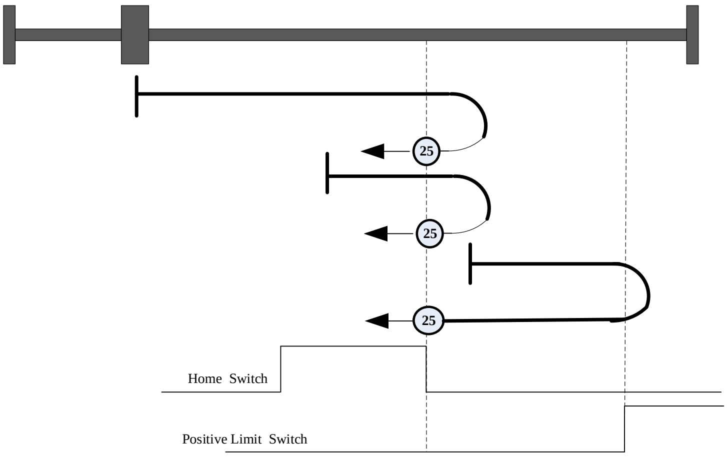
Homing method 24: Homing on positive limit switch and homing on positive home switch(rising edge of home switch)

Signal: home switch and positive limit

<table>
<tr><th>Description</th><th>Explanatory chart</th></tr>
<tr><td>As shown in the figure, there are three cases for this mode:
Case 1: The load is in the negative home switch position
1. Run to the home switch in the positive direction and decelerate and stop;
2. Set this position as zero.
Case 2: The load is in the home switch position
1. Run in the negative direction and leave the home switch before deceleration and stop;
2. Run to the home switch in the positive direction and decelerate and stop;
3. Set this position as zero.
Case 3: The load is in the positive home switch position
1. Run to the positive limit switch in the positive direction and decelerate and stop;
2. Run in the negative direction and leave the home switch before deceleration and stop;
3. Run to the home switch in the positive direction and decelerate and stop;
4. Set this position as zero.</td><td>
</td></tr>
</table>

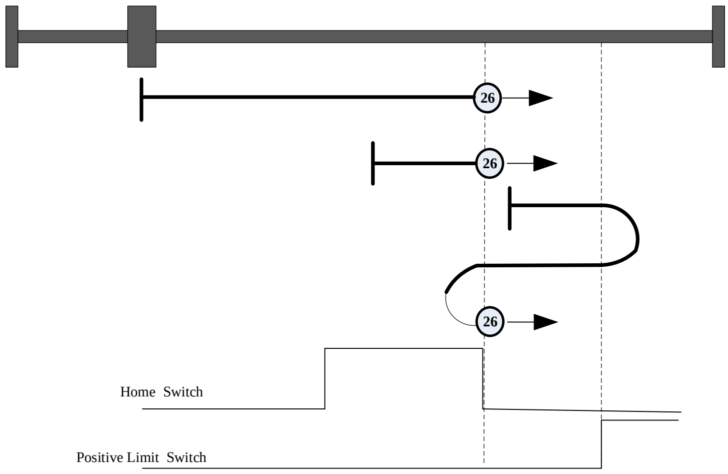
Homing method 25: Homing on positive limit switch and homing on negative home switch(rising edge of home switch)

Signal: home switch and positive limit

Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1:** The load is in the negative home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Run to the home switch in the negative direction and decelerate and stop; 3. Set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Run to the home switch in the negative direction and decelerate and stop; 3. Set this position as zero. **Case 3:** The load is in the positive home switch position 1. Run to the positive limit switch in the positive direction and decelerate and stop; 2. Run to the home switch in the negative direction and decelerate and stop; 3. Set this position as zero.	

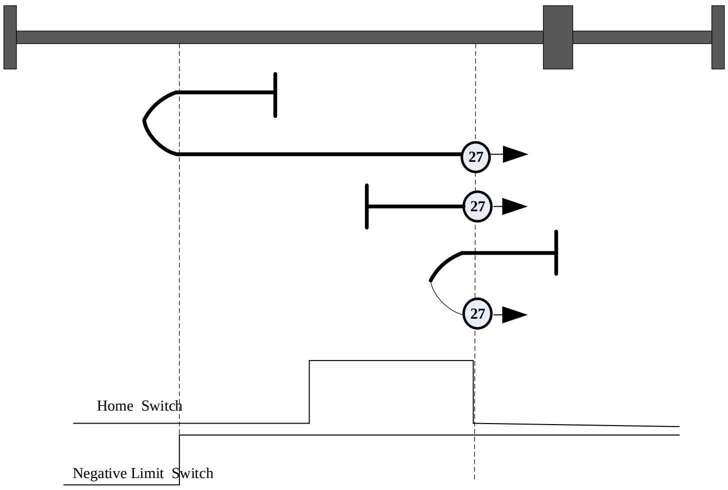
Homing method 26: Homing on positive limit switch and homing on negative home switch(falling edge of home switch)

Signal: home switch and positive limit

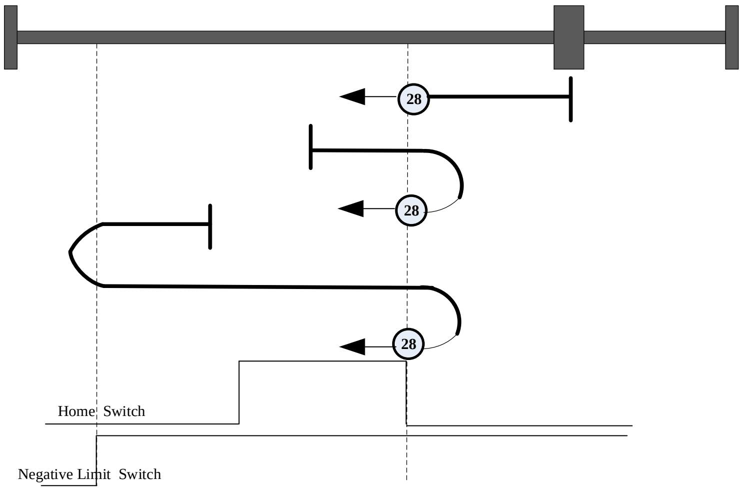
Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1:** The load is in the negative home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Set this position as zero. **Case 3:** The load is in the positive home switch position 1. Run to the positive limit switch in the positive direction and decelerate and stop; 2. Run to the home switch in the negative direction and decelerate and stop; 3. Run in the positive direction and leave the home switch before deceleration and stop; 4. Set this position as zero.	

Homing method 27: Homing on negative limit switch and homing on positive home switch(falling edge of home switch)

Signal: home switch and negative limit

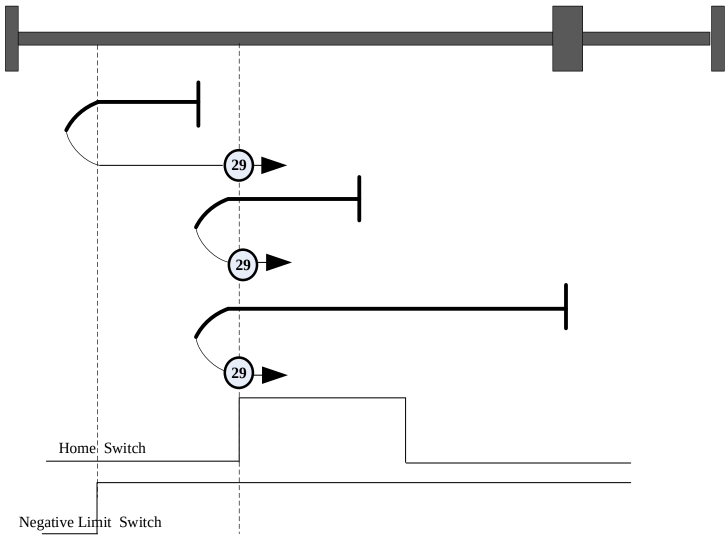
Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1:** The load is in the negative home switch position 1. Run to the negative limit switch in the negative direction and decelerate and stop; 2. Run in the positive direction and leave the home switch before deceleration and stop; 3. Set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Set this position as zero. **Case 3:** The load is in the positive home switch position 1. Run to the home switch in the negative direction and decelerate and stop; 2. Run in the positive direction and leave the home switch before deceleration and stop; 3. Set this position as zero.	

Homing method 28: Homing on negative limit switch and homing on positive home switch(rising edge of home switch)
Signal: home switch and negative limit

Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1**: The load is in the positive home switch position 1. Run to the home switch in the negative direction and decelerate and stop; 2. Set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the positive direction and leave the home switch before deceleration and stop; 2. Run to the home switch in the negative direction and decelerate and stop; 3. Set this position as zero. **Case 3:** The load is in the negative home switch position 1. Run to the negative limit switch in the negative direction and decelerate and stop; 2. Run in the positive direction and leave the home switch before deceleration and stop; 3. Run to the home switch in the negative direction and decelerate and stop; 4. Set this position as zero.	

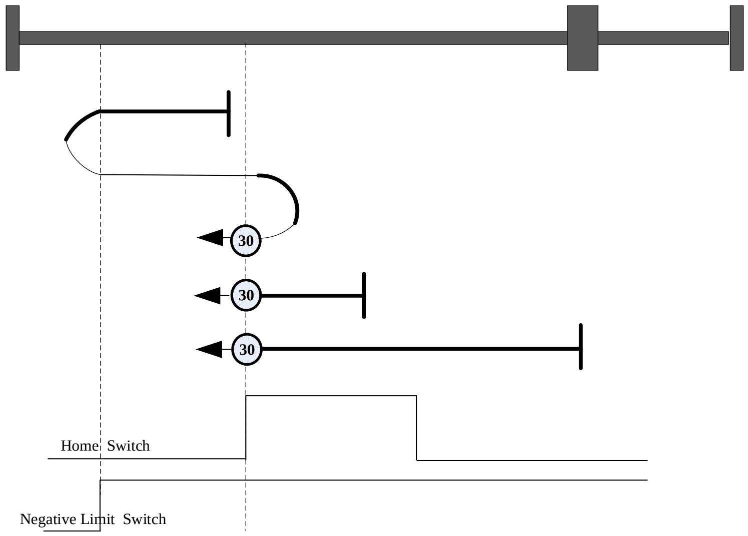
Homing method 29: Homing on negative limit switch and homing on negative home switch(rising edge of home switch)

Signal: home switch and negative limit

Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1:** The load is in the negative home switch position 1. Run to the negative limit switch in the negative direction and decelerate and stop; 2. Run to the home switch in the positive direction and decelerate and stop; 3. Set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Run to the home switch in the positive direction and decelerate and stop; 3. Set this position as zero. **Case 3:** The load is in the positive home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Run to the home switch in the positive direction and decelerate and stop; 3. Set this position as zero.	

Homing method 30: Homing on negative limit switch and homing on negative home switch(falling edge of home switch)

Signal: home switch and negative limit

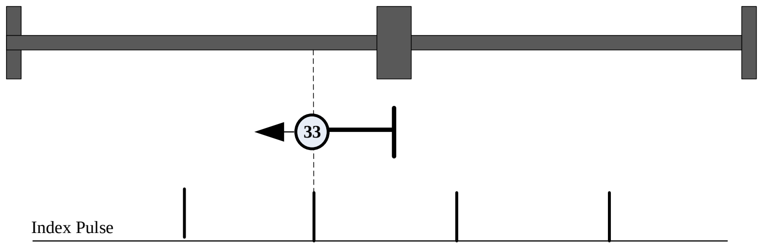
Description	Explanatory chart
As shown in the figure, there are three cases for this mode: **Case 1:** The load is in the negative home switch position 1. Run to the negative limit switch in the negative direction and decelerate and stop; 2. Run to the home switch in the positive direction and decelerate and stop; 3. Run in the negative direction and leave the home switch before deceleration and stop; 4. Set this position as zero. **Case 2:** The load is in the home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Set this position as zero. **Case 3:** The load is in the positive home switch position 1. Run in the negative direction and leave the home switch before deceleration and stop; 2. Set this position as zero.	

Homing method 31: reserved

Homing method 32: reserved

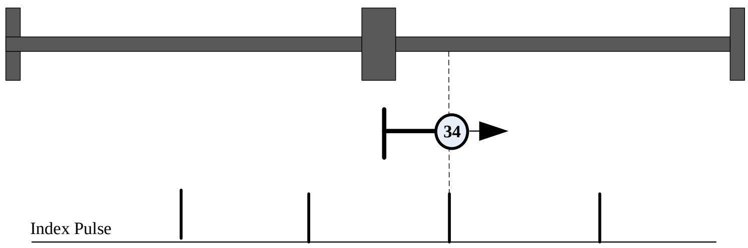
Homing method 33: Homing on the index pulse(negative direction)

Signal: index signal

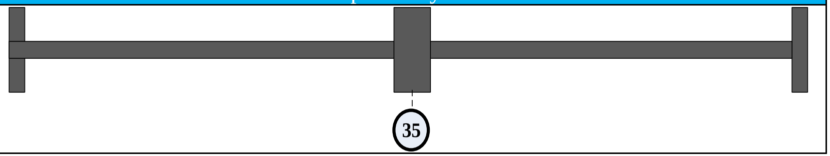
Description	Explanatory chart
Situation I: 1. Run to the 1st index signal in negative direction; 2. Set this position as zero.	

Homing method 34: Homing on the index pulse(positive direction)

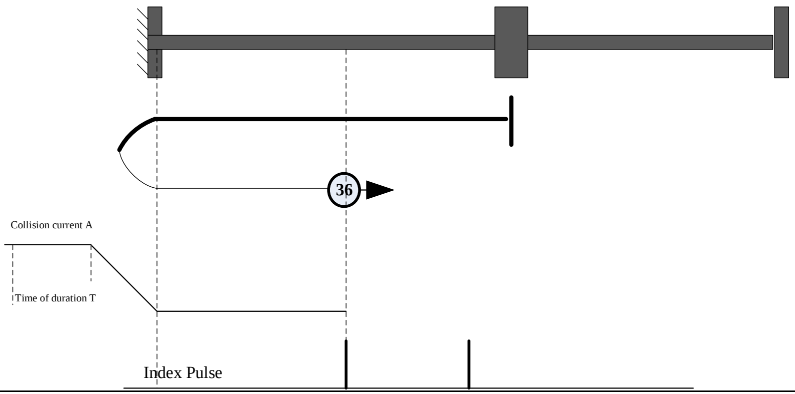
Signal: index signal

Description	Explanatory chart
Situation I: 1. Run to the 1st index signal in positive direction; 2. Set this position as zero.	

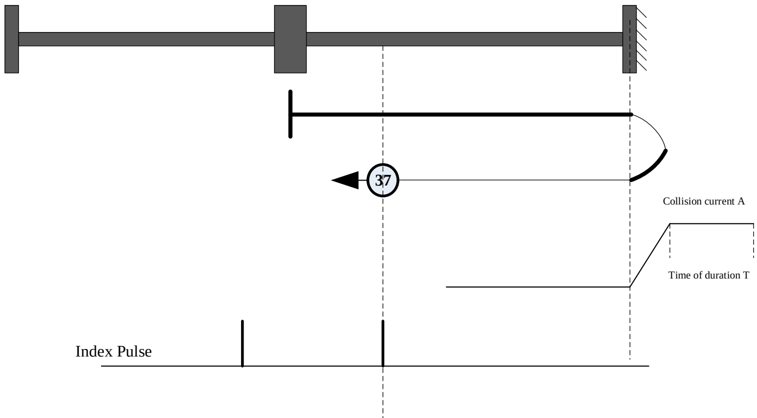
Homing method 35: Homing on the index pulse (current position)
Signal: No

<table>
<tr><th>Description</th><th>Explanatory chart</th></tr>
<tr><td>The current position shall be taken to be the home position.</td><td>
</td></tr>
</table>

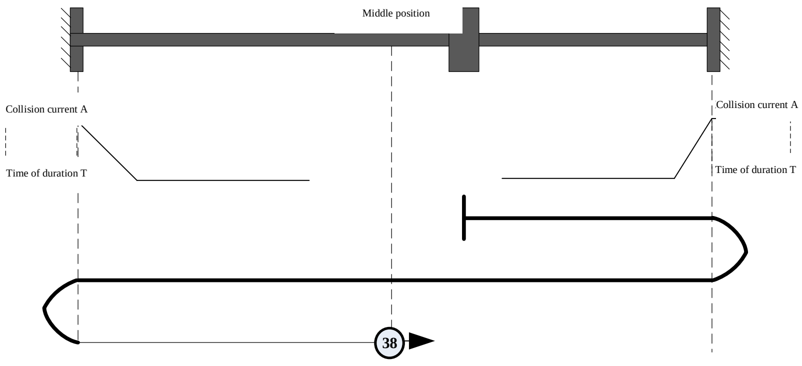
Homing method 36: Homing with negative collision (negative direction)
Signal: wall, index signal

<table>
<tr><th>Description</th><th>Explanatory chart</th></tr>
<tr><td>1. Move in the negative direction until hit the mechanical edge;
2. When the current reaches the collision current, move the load in the positive direction and decelerate and stop when encountering the 1st Index signal;
3. Run to the Index position and set this position as zero.</td><td>
</td></tr>
</table>

Homing method 37: Homing with positive collision (positive direction)
Signal: wall, index signal

<table>
<tr><th>Description</th><th>Explanatory chart</th></tr>
<tr><td>1. Move in the positive direction until hit the mechanical edge;
2. When the current reaches the collision current, move the load in the negative direction and decelerate and stop when encountering the 1st Index signal;
3. Run to the Index position and set this position as zero.</td><td>
</td></tr>
</table>

Homing method 38: Homing with collision from two sizes (negative and positive direction)
Signal: wall, index signal

Description	Explanatory chart
1. Move in the positive direction until hit the mechanical edge; 2. When the current reaches the collision current, move in the negative direction until hit the mechanical edge; 3. When the current reaches the collision current, move in the positive direction to the middle position which will be taken as the zero point.	

5.7 Multi-stage control function

In some cases, customers need to control the motor without using pulse, to realize the movement and switching of multiple fixed positions.

Ω6 servo can provide up to 32 relative positions and 32 absolute positions, and each position can be configured with a different running speed. The position to be reached is realized by combining different "module number setting inputs", and the motor is started to reach the position set by the corresponding "module number setting input" by the rising edge of strobe input".

Different module number designation input combinations can correspond to different positions, and the specific corresponding formula is as follows

$$\begin{aligned}\text{Arriving position} = {} & (\text{Module number designation input1}) \times 10^0 + (\text{Module number designation input2}) \times 10^1 \\ & + (\text{Module number designation input4}) \times 10^2 + (\text{Module number designation input8}) \times 10^3 \\ & + (\text{Module number designation input16}) \times 10^4\end{aligned}$$

When corresponding "Module number designation input" has a signal, the corresponding "Module number designation input" is 1, and other "Module number designation input" are 0.

For example: when "Module number designation input1" has a signal, and "Module number designation input4" has a signal, the following can be obtained according to reduction formula:

$$\text{Arriving position} = 1 \times 1 + 0 \times 2 + 1 \times 4 + 0 \times 8 + 0 \times 16 = 5$$

The position 5 to be reached.

5.7.1 Relative position control

Relative position is the distance moved from the current position, as shown in the figure below:

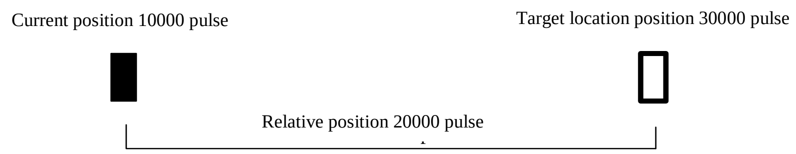


Figure 5.7.1-1 Relative position control

The specific realization method of relative position control is as below:

1. When relative position control is used, Pr21.0 multi-stage position control mode should be selected as 0;
2. Configure module number designation input;
3. Set the relative position and speed of multi-stage position;
4. Servo enabling, to trigger"strobe input".

5.7.2 Absolute position control

The absolute position is the distance to be set from the current position, as shown in the following figure:

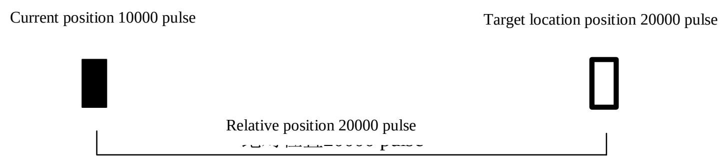


Figure 5.7.2-1 Absolute position control

The specific realization method of absolute position control is as below:

1. When absolute position control is used, Pr21.0 multi-stage position control mode should be selected as 1;
2. It is required to configure multi-stage absolute position mode Pr21.1. When it is configured as 0, absolute position controls the running in the forward direction, always running in the forward direction

(for rotary motion mode); when it is configured as 1, absolute position controls the running in the reverse direction, always running in the reverse direction (for rotary motion mode); when it is configured as 2, the absolute position controls the running in the forward/reverse directions, running towards the direction closest to the current position.

3. Configure module number designation input;
4. Set the relative position and speed of multi-stage position;
   Servo enabling, to trigger “strobe input”.

Chapter 6 Troubleshooting

6.1 Key points of confirmation

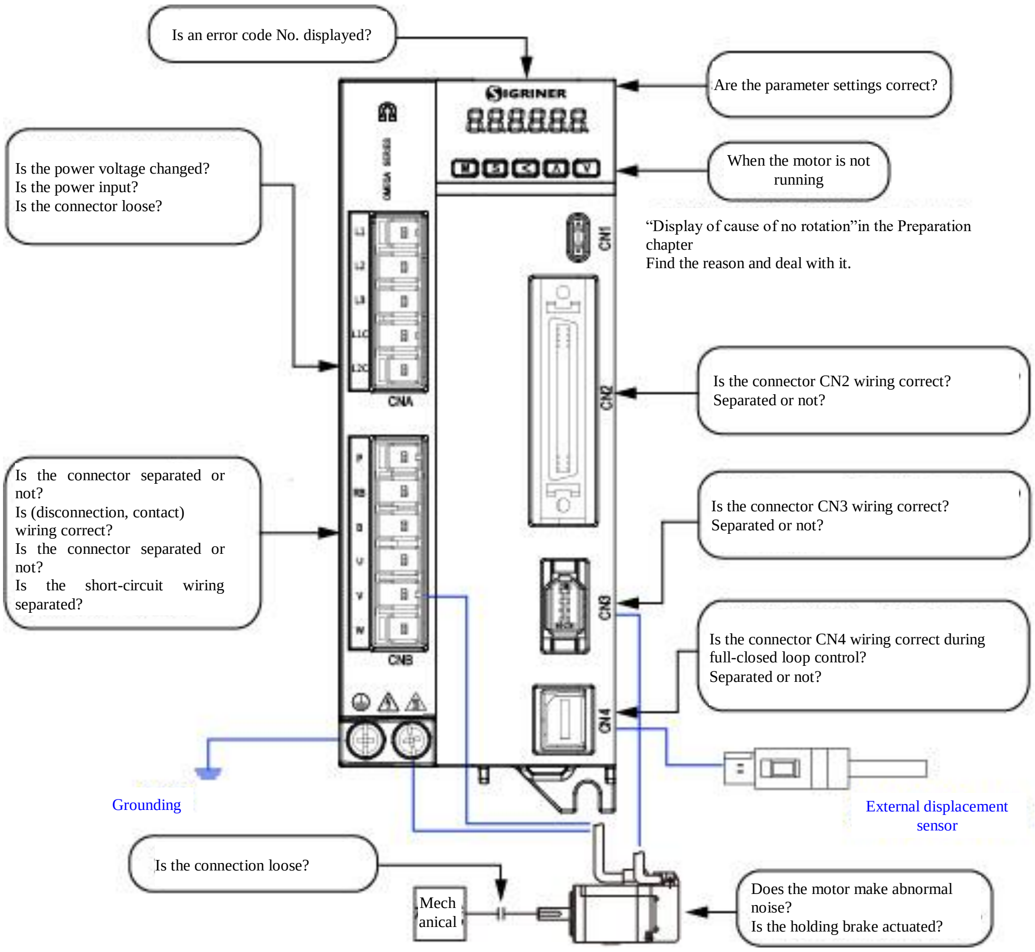


Figure 6.1-1 Fault point confirmation

6.2 Fault list

6.2.1 Protection function (Alarm code)

The drive has various protection functions. When a protection function works, an alarm is given after the motor stops, and the servo alarm output (ALM) occurs.
Alarm status and handling:
1. In alarm state, the front panel LED displays alarm code No., and the servo enabling cannot be turned on.
2. The alarm state can be released when the alarm clear input (A-CLR) is turned on for more than 120ms.
3. When overload protection acts, it can be cleared by alarm clearing signal (A-CLR) after about 10 seconds from the occurrence of alarm. When the control power supply L1C and L2C of the driver are turned on again, the overload protection time limit characteristic can be cleared.
4. The above alarm can be cleared by operating the front panel or the installation and debugging software “Ω Master” of the computer.
Please clear the alarm when the machine stops after eliminating the cause of abnormality and ensuring safety.
List of alarm codes

Alarm code		Content	Properties		
Master code	Auxiliary code		History record	Clearable	Stop immediately
12	0	Overvoltage protection	○	○	
13	0	Under-voltage protection for main power supply (insufficient voltage between PN)		○	
	1	Under-voltage protection for main power supply (AC cut off detected)		○	○
14	0	Overcurrent protection	○		
	1	IPM fault protection	○		
15	0	Overheating protection	○		○
	1	Encoder overheating fault protection	○		○
16	0	Overload protection	○	○*1	Switchable*1
	1	Torque saturation fault protection	○	○	
18	0	Regenerative overload protection	○		○
	1	Regenerative transistor fault protection	○		
21	0	Encoder communication disconnection fault protection	○		
	1	Encoder communication fault protection	○		
23	0	Encoder communication data fault protection	○		
24	0	Excessive positional deviation protection	○	○	○
	1	Excessive Speed deviation protection	○	○	○
26	0	Overspeed protection	○	○	○
	1	2nd over-speed protection	○	○	
27	0	Command pulse input frequency fault protection	○	○	○
	2	Command pulse frequency multiplication fault protection	○	○	○
28	0	Pulse regeneration limit protection	○	○	○
31	0	Safety function fault protection	○		
33	0	I/F input repeated allocation abnormality 1 protection	○		
	1	I/F input repeated allocation abnormality 2 protection	○		
	2	I/F input function number abnormality 1	○		
	3	I/F input function number abnormality 2	○		

	4	I/F input function number fault	○		
	5	I/F input function number abnormality 2	○		
	6	Counter clear allocation fault	○		
	7	Command pulse disabled input allocation fault	○		
34	0	Motor movable range setting fault protection	○	○	
37	6	PowerID error			
38	0	drive disabled input protection		○	
39	0	Excessive analog input AI1 protection	○	○	○
	1	Excessive analog input AI2 protection	○	○	○
	2	Excessive analog input AI3 protection	○	○	○
40	0	Absolute system battery voltage abnormal protection	○	○*2	
41	0	Absolute counter overflow fault protection			
42	0	Absolute over-speed fault protection	○	○*2	
44	0	Single-loop counting fault protection	○		
45	0	Multi-loop counting fault protection	○		
47	0	Absolute state fault protection	○		
72	0	Temperature sensor fault	○		
87	0	Forced alarm input protection		○	○
92	0	Encoder data recovery fault protection	○		
	6	Encoder position angle recognition failed	○	○	
	7	Load inertia ratio identification failed	○	○	
96	2	Control unit fault protection	○		
98	0	Homing fault	○	○	
99	0	Micro commutation failed	○		

Note 1: When Err16.0 “overload protection”acts, the error can be cleared 10 seconds after occurrence. Err16.0 “overload protection” can be switched between valid and invalid through bit11 of Pr.6.47 “function extension setting 2”. The factory value is set to be invalid.

Note 2: In case of Err40.0 “absolute system battery voltage anomaly protection” and Err42.0 “absolute overspeed anomaly protection”, the alarm cannot be cleared until the absolute encoder is reset.

6.2.2 Protection function (Alarm code details)

Master code	Auxiliary code	Protection functions	Cause	Treatment
12	0	Overvoltage Protection	The voltage between P and N at the rectifier position is higher than the specified value. 200V product: about DC420V (about AC297V) ① The power supply voltage exceeds the allowable input voltage range. This is because the AC input power is too high. ② Disconnection of regenerative resistor ③ The external regenerative resistor is not matched, which leads to the inability to absorb regenerative energy. ④ Driver failure (circuit failure) ⑤ After an external regenerative resistor is connected, it will happen whether the regenerative energy can be absorbed or not.	Measure the L1, L2 and L3 line voltages of connectors and terminal blocks. ① Input correct input voltage. ② Use a multimeter to measure the resistance value of the external resistor between the driver terminals P and B, and ∞ indicates disconnection. The external resistor should be replaced. ③ Change to the specified regenerative resistance value and wattage. ④ Replace a new driver. ⑤ Confirm the set value of Pr0.16.
13	0	Insufficient voltage protection of main power supply (PN)	When Pr5.08=1, the instantaneous stop time between L1 and L3 exceeds the time set by Pr5.09. Or the voltage between P and N at the rectifier position of main power supply is lower than the specified value during servo enabling. 200V product: Approximately DC160V (about AC113V) ① Low input voltage. Instantaneous power failure ② Instantaneous power failure ③ The input power supply capacity is insufficient, which is affected by the impact current when the main power supply is turned on, resulting in a drop in the power supply voltage. ④ Default phase The driver of three-phase input specification operates under single-phase power supply; one phase of L1 or L3 is not connected. ⑤ Driver failure (circuit failure)	Measure the line-to-line voltage of L1, L2, L3 of the connectors and terminal blocks. ① Improve the capacity of power supply voltage. Replace the power supply. Eliminate the cause of the main power contactor and turn on the power again. ② Try to extend the Pr5.09 set value. ③ Increase power capacity. ④ Connect each phase of the power supply correctly (L1, L2, L3) ⑤ Replace a new driver.
	1	Insufficient voltage protection of main power supply (AC)		
14	0	Overcurrent protection	The current flowing through the rectifier exceeds the specified value. ① Driver failure (IGBT or other circuit faults, etc.) ② Short connection of motor cables U, V, W. ③ Motor wire grounding. ④ Motor burning. ⑤ Bad motor wire contact. ⑥ The relay failure of dynamic brake is caused by frequent enabling and disabling of servo. ⑦ The time of pulse input and servo enable is synchronized or the pulse input is too fast. ⑧ Power module overheat protection.	① Remove the motor cable and turn on the servo. If a fault occurs immediately, it is necessary to replace the driver with a new one. ② Check whether the motor wire connections U,V,W v and w are short-circuited and whether the connector wire has burrs. ③ Connect the motor cable correctly. Check the insulation resistance between the U, V, W of motor cable and the motor wire. Replace the motor with a new one when it is in low insulation. ④ Check whether the resistance between the motor wires is balanced. If it is unbalanced, replace the motor.

	1	IPM abnormality protection IPM : Intelligent power module		⑤ Check whether the connector terminals of motor U, V and W are separated, and tighten them if they are loose or separated. ⑥ Replace a new driver. The motor rotation and stop are not controlled through servo enabling on/off switching. ⑦ Input pulse instruction 100 ms after servo enabling is turned on. ⑧ Improve the capacity of driver and motor. Extend the acceleration/deceleration time. Reduce the load.
15	0	Overheating protection	The temperature of the radiator and power devices of the driver exceeds the specified value. ① The surrounding temperature of the driver exceeds the specified value. ② Overload.	① Improve the ambient temperature and cooling conditions of the driver. ② Increase the capacity of driver and motor. Extend the acceleration/deceleration time. Reduce the load.
	1	Encoder overheating fault protection	The encoder temperature exceeds the encoder overheat threshold when the encoder overheat abnormality protection detected by bit 11 of Pr6.10 is valid (the initial set value is invalid). ① The ambient temperature of servo motor is high. ② Overload.	① Improve the ambient temperature and cooling conditions of the motor. ② Increase the capacity of driver and motor. Extend the acceleration/deceleration time. Reduce the load.
16	0	Overload protection 1 (Overload protection 1)	Overload protection occurs when the actual action value of torque command exceeds the time limit characteristic of overload protection. ① The load is too heavy, the actual torque exceeds the rated torque, and it keeps running for a long time. ② Poor gain adjustment leads to vibration. Vibration and abnormal sound of motor. Set value of Pr0 is abnormal. ③ Wrong and broken wiring of motor. ④ Mechanical collision, mechanically suddenly heavier, mechanical distortion. ⑤ The motor acts when the brake is not turned on. ⑥ In the wiring of multiple machines, motor wire is connected to other shafts by mistake, and the wiring is wrong.	Check whether the torque (current) waveform oscillates and vibrates excessively up and down by analog output or communication. Confirm overload warning display and load rate through communication or front panel. ① Increase the capacity of driver and motor. Increase acceleration/deceleration time and reduce load. ② Readjust the gain. ③ Connect the motor wires correctly according to wiring diagram. Replace the cable. ④ Exclude mechanical distortion factors. Reduce the load. ⑤ Measure the voltage of the brake terminal. Open the brake. ⑥ Connect the motor wire and encoder wire to the corresponding shaft correctly.
			P.6-16 records the time limit characteristics of overload protection.	
			Caution→ This alarm can be cleared after 10 seconds.	
	1	Torque saturation abnormality protection	The continuous occurrence of torque saturation actually reaches the set time of Pr6.57 "torque saturation abnormality protection detection time".	・Confirm the action state of the driver. ・Execute the same processing as Err16.0.

<table>
<tr><td rowspan="3">18</td><td rowspan="2">0</td><td rowspan="2">Regenerative braking overload protection</td><td>Regenerative energy exceeds the processing capacity of regenerative resistor.

① Due to large load inertia, regenerative energy will be formed during deceleration, resulting in a rise in capacitor voltage, as well as a rise in voltage due to insufficient energy absorption of the regenerative resistor.
② The motor rotates too fast to fully absorb regenerative energy within the specified deceleration time.
③ The action limit of external resistor is limited to 10%
duty cycle.</td><td>Confirm the regenerative resistance load rate with the front panel or communication. Not available for continuous regenerative braking.
① Confirm the action. Inspect the regenerative resistor load factor and over-regeneration warning display. Increase the capacity of motor and driver and slow down the deceleration time. Use an external regenerative resistor.
② Confirm the action. Inspect the regenerative resistor load factor and over-regeneration warning display. Increase the capacity of motor and driver and slow down the deceleration time. Reduce the motor speed. Set an external regenerative resistor.
③ Set Pr0.16 as 2.</td></tr>
<tr><td colspan="2">Caution→ When Pr0.16 is set to 2, it is required to set external protection such as temperature fuse. If the regenerative resistor is not protected, it may cause the burning loss of the regenerative resistor due to abnormal heating.</td></tr>
<tr><td>1</td><td>Regenerative braking hardware abnormality</td><td>① Transistor failure for regenerative driving of the driver
② Regenerative resistor not connected</td><td>① Replace a new servo driver
② Connect the regenerative resistor correctly
Set Pr0.16 as 2</td></tr>
<tr><td rowspan="2">21</td><td>0</td><td>Encoder communication disconnection fault protection</td><td>The continuous interruption of the communication between encoder and driver reaches a certain number of times.</td><td>Connect the encoder wires correctly according to wiring diagram.
Correct the wrong connection of connector terminals.</td></tr>
<tr><td>1</td><td>Encoder communication fault protection</td><td>The data communication of encoder is abnormal.
Data abnormality mainly caused by interference.
Although connected with encoder line, the communication data is abnormal.</td><td rowspan="2">・Be sure that the power supply voltage of encoder is
DC4.75 V ~ 5.25 V…which should be paid special attention to when encoder line is longer.
・If the motor wire and encoder wire are bundled together, please separate them.
・Connect the shielding layer to PE.</td></tr>
<tr><td>23</td><td>0</td><td>Encoder communication data fault protection</td><td>The data communication of encoder is not abnormal, but the data content is abnormal. Data abnormality mainly caused by interference.
Although connected with encoder line, the communication data is abnormal.</td></tr>
<tr><td rowspan="2">24</td><td>0</td><td>Excessive positional deviation protection</td><td>The positional deviation pulse exceeds Pr0.14 setting.
① The motor does not act as commanded.
② Pr0.14 (excessive positional deviation setting) value is too small.</td><td>① Inspect whether the motor rotates according to the position command pulse. Confirm that the output torque under torque monitoring is not saturated. Adjust the gain. Pr0.13 and Pr5.22 are set as the maximum values. Connect the encoder wires correctly according to wiring diagram, and extend the acceleration/deceleration time. Reduce the load and speed.
② Increase the set value of Pr0.16.</td></tr>
<tr><td>1</td><td>Excessive speed deviation protection</td><td>Difference between internal command speed and actual speed (speed deviation exceeds the setting of Pr6.02.
Note) Due to immediate stop of command pulse input prohibition (INH) or positive/negative drive prohibition input, when the internal position command speed is forcibly set as 0, the speed deviation will increase at this moment. The speed deviation will also become large when the internal position command speed starts, so a sufficient margin should be set.</td><td>・Increase the set value of PR6.02.
・Increase the acceleration/deceleration time of the internal position command speed, or improve the responsiveness through gain adjustment.
・Set the detection of excessive speed deviation as invalid. (Pr6.02=0)</td></tr>
</table>

26	0	Overspeed protection	The rotation speed of the motor exceeds the set value of Pr5.13.	・ Avoid the excessive speed command. ・ Confirm the command pulse input frequency and frequency division/multiplication ratio. ・Adjust the gain when overshoot occurs due to improper gain adjustment. ・ Connect the encoder wires correctly according to the wiring diagram.
	1	The 2nd overspeed protection	The rotation speed of the motor exceeds the set value of Pr6.15.	
27	0	Command pulse input frequency fault protection	Command pulse input frequency exceeds the set value of Pr5.32 ×1.2 times.	Confirm the command pulse input.
	2	Command pulse frequency multiplication fault protection	The frequency division/multiplication ratio set by the number of command pulses in one turn, the 1st to 4th command division/multiplication numerator and the command division/multiplication denominator is inappropriate. The product value of the command pulse number and the command frequency division/multiplication ratio exceeds about 5000Mpps. Command pulse input has different density. A counting error is caused in command pulse input due to interference.	・The frequency division/multiplication ratio should be set as the minimum value in the scope of 1/1000～8000 times. ・ Confirm the command pulse input. ・Use a long-wire-driven interface whenever possible. Set Pr5.32 (maximum setting of command pulse input/setting of digital filter) as less than 1000, and try to make the digital filter take effect.
28	0	Pulse regeneration limit protection	The output frequency of pulse regeneration exceeds the limit.	・Confirm the set values of Pr0.11 and Pr5.03. ・When it is invalid, Pr5.33 should be set as 0.
31	0	STO input abnormality	STO input safety function abnormality	・ Confirm whether CN8 terminal is correctly wired. ・Replace the servo driver if correct wiring still occurs many times.
33	0	I/F input repeated allocation abnormality 1 protection	The function allocation of input signals (SI1, SI2, SI3, SI4, SI5) is repeatedly set.	Please set the function assignment of connector pins correctly.
	1	I/F input repeated allocation abnormality 2 protection	The function allocation of input signals (SI6, SI7, SI8, SI9, SI10) is repeatedly set.	
	2	I/F input function serial number abnormality 1	The input signals (SI1, SI2, SI3, SI4, SI5) are not defined for numbering in function allocation.	
	3	I/F input function serial number abnormality 2	The input signals (SI6, SI7, SI8, SI9, SI10) are not defined for numbering in function allocation.	
	4	I/F output function serial number abnormality 1	The output signals (SO1, SO2, SO3) are not defined for numbering in function allocation.	
	5	I/F output function serial number abnormality 2	The output signals (SO4, SO5, SO6) are not defined for numbering in function allocation.	
	6	Cl allocation abnormality	The counter clearing function is assigned to be beyond the input signal SI7.	

	7	INH allocation abnormality	The command pulse prohibits the input function from being assigned to be beyond the input signal SI10.	
34	0	Motor movable range setting fault protection	Compared with the position command input range, the motor movable range exceeds the motor movable range set in Pr5.14. ① The gain is not suitable. ② The set value of Pr0.16 is too small. ③ When Pr6.97"function extension setting 3"bit2=1, the conditions for compulsory occurrence of Err34.0 are met.	① Confirm gain (balance between position loop gain and speed loop gain) and inertia ratio. ② Increase the set value of PR6.02. Or set Pr5.14 as 0, to disable the protection function. ③ Modify setting conditions and action conditions. Please refer to the cautions of "motor movable range protection Err34.0".
37	6	PowerID error	Driver abnormality	Replace the driver
38	0	Drive prohibition input protection	When Pr5.04"Drive prohibition input setting"=0, positive/negative drive prohibition input (POT/NOT) is in On state. WhenPr5.04=2, either of positive/negative drive prohibited input (POT/NOT) is in On state.	・Confirm whether the connection switch, wire and power supply of the positive/negative drive prohibition input are abnormal. Especially, it is necessary to confirm whether the starting of the control signal power supply (DC12 〜 24V) is delayed.
39	0	Excessive analog input 1 (AI1) protection	Apply a voltage above the set value of Pr4.24 to analog input 1.	・Set Pr4.24 correctly. Confirm the connection status of the connector CN2. ・Pr4.24 is set as 0, and the protection function is invalid.
	1	Excessive analog input 2 (AI2) protection	Apply a voltage above the set value of Pr4.27 to analog input 2.	・Set Pr4.27 correctly. Confirm the connection status of the connector CN2. ・Pr4.27 is set as 0, and the protection function is invalid.
	2	Excessive analog input 3 (AI3) protection	Apply a voltage above the set value of Pr4.30 to analog input 3.	・Set Pr4.30 correctly. Confirm the connection status of the connector CN2. ・Pr4.30 is set as 0, and the protection function is invalid.
40	0	Absolute system battery voltage abnormal protection	The power supply to encoder and battery power drop, and the internal voltage is lower than the specified value. Caution→ In case of a secondary alarm, if the absolute encoder is not cleared, the alarm cannot be cleared.	After the battery power supply is connected, reset the absolute encoder.
41	0	Absolute counter overflow fault protection	Encoder multi-turn count exceeds the specified value.	・Set Pr0.15 as 2 regardless of multi-turn counter overflow. ・Set the movement amount starting from the mechanical home to be within 32767 turns.
42	0	Absolute overspeed abnormality protection	When the absolute encoder is used ④ In case of power failure or power supply only by battery, the motor rotation speed exceeds the stipulated value. ⑤ During normal running, encoder power supply is disconnected due to some reasons, and the rotation speed exceeds the stipulated value.	① Confirm whether the motor is driven by an external force, and also confirm the current rotation speed, and operate to ensure the rotation speed to be below the stipulated value. ② During normal running, confirm the power voltage (5V±5%) of encoder side ・starting from switching to power failure mode ・ Confirm the connection status of the connector CN3.

Caution→ In case of a secondary alarm, if the absolute encoder is not cleared, the alarm cannot be cleared.

44	0	Absolute/incremental single turn counter abnormality protection	Absolute: single turn counting abnormality protection Incremental: single turn counting abnormality protection	Replace the motor
45	0	Absolute multiturn counter/incremental multiturn counter abnormality protection	Absolute: Multiturn counter abnormality protection Incremental: single turn counting abnormality protection	Replace the motor
47	0	Absolute state fault protection	Encoder rotation exceeds the specified value when power is switched on.	Avoid the motor acting when it is powered on.
87	0	Mandatory warning input protection	Input mandatory warning input (E-STOP).	Confirm the wiring of mandatory warning input (E-STOP).
92	6	Encoder position angle recognition failed	① Motor phase sequence error. ② Motor parameter setting error ③ The motor brake is not turned on. ④ The load is too large	① Replace any two-phase sequence of the motor. ② Check the motor parameters (especially the number of pole pairs and the single-turn resolution of encoder, etc.) ③ Detect if the motor brake is open ④ Reduce the load
	7	Load inertia ratio identification failed	① Too short running distance. ② Parameters such as identification speed and acceleration are set irrationally ③ The value of P0.04 is quite different from the actual load inertia ratio ④ Improper gain parameter	① Set an appropriate running distance. ② Set approximate identification speed, acceleration and other parameters ③ Estimate a suitable inertia ratio and set it to P0.04 ④ Confirm gain (balance between position loop gain and speed loop gain), to make sure that no oscillation is produced during control
96	2	Control unit fault protection	Abnormality in control unit of servo driver.	Turn off the power supply and turn it on again. If the abnormality still exists, please replace the driver.
98	0	Homing fault	The conditions of returning to zero are not satisfied	Confirm whether the conditions of returning to zero like zero return switch are correct
99	0	Micro commutation failed	Motor power-on micro-motion commutation failed ① Motor phase sequence error. ② Motor parameter setting error ③ The load is too large	① Replace any two-phase sequence of the motor. ② Check the motor parameters (especially the number of pole pairs and the encoder resolution, etc.) ③ Reduce the load and put the linear motor in the middle position

1. On the settings of Pr5.13 “overspeed grade” and Pr6.15”2nd overspeed grade”

Even if the immediate stop function is used, the motor may still fail to stop running normally. For example, as shown in the following figure, when the motor speed exceeds Pr5.13 “overspeed grade setting”, even if immediate stop action command is input, the motor cannot be controlled, and the motor speed increases. Err26.1 “2nd overspeed protection” is set as a safety measure for this situation. Since Err26.1 is an alarm not corresponding to immediate alarm, the motor enabling is disconnected, and the alarm is stopped according to timing action B. Please set the allowable speed level in Pr6.15”2rd overspeed grade”.

In addition, compared with Pr6.15, Pr5.13 should be set as a lower value with sufficient margin. Err26.0 and Err26.1 will occur simultaneously when the margin is small or the set value is the same. At this time, Err26.0 occurs, for Err26.1 also occurs internally, so an alarm not corresponding to immediate stop is preferred, and immediate stop is not performed. And when Pr6.15 is set lower than Pr5.13, as Err26.1 takes precedence over Err26.0, no immediate stop is required.

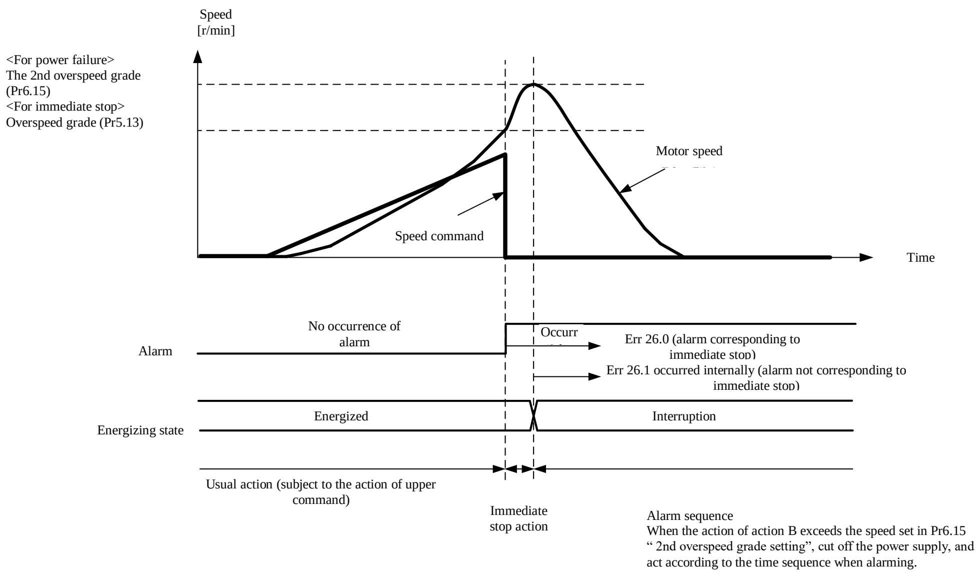


Figure 6.2.2-1 Overspeed protection

2. Motor moveable range protection (Err34.0)

I. General

Relative to the range of position command input, when the motor exceeds the possible range of motor action set in Pr5.14, the motor can be stopped through the alarm of “motor moveable range protection”.

Through this function, it is able to prevent the motor from colliding with the mechanical end due to oscillation.

2. Scope of application

This function cannot work when the following conditions are not met.

	Operating conditions of motor movable range setting function
Control mode	Position control, full closed-loop control
Other	To be in the servo ON state. Approximately set the parameters other than control, such as deviation counter reset command input prohibition and torque limit setting, to make the motor rotate normally without obstacles.

3. Precautions

Please note that this function has no protection function for abnormal position command.

When protection action is set for the motor movable range, decelerate and stop according to Pr5.10 “Sequence at alarm”.

According to different loads, in the process of deceleration, the load sometimes sometimes collides with the mechanical end, causing damages, so please estimate the setting range of Pr5.14 after deceleration.

When the motor movable range ([encoder pulse] or [external displacement sensor pulse] unit) exceeds $\pm 2^{31}$, Err34.0”motor movable range setting abnormality protection”is invalid.

4. Action example:

(1) When position command is not input (at Servo-ON)

As the position command is not input, the motor movable range is the range of movement amount set by Pr5.14 on both sides of the motor position. If entering the range where alarm occurs due to vibration (the range indicated by shallow oblique lines), the motor movable range setting protection occurs.

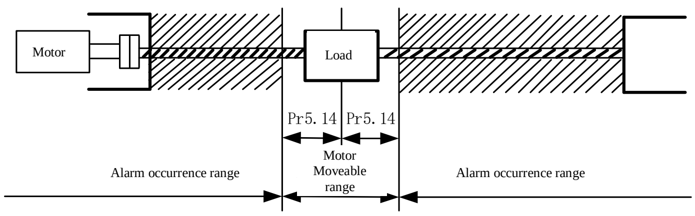


Figure 6.2.2-2 Motor moveable range protection

(2) In case of action on the right side (at Servo-ON)

After inputting the position command in the right direction, the possible action range of the motor is

expanded to the extent shown by the input position command, and the rotation number range set by Pr5.14 is on both sides of the position command input range.

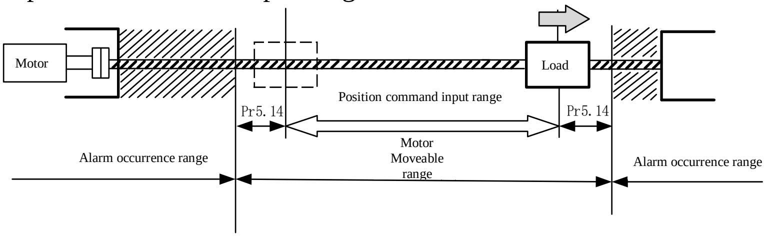


Figure 6.2.2-3 Motor moveable range protection

(3) In case of action on the left side (at Servo-ON)
After inputting the position command in the left direction, the position command input range will be further extended.

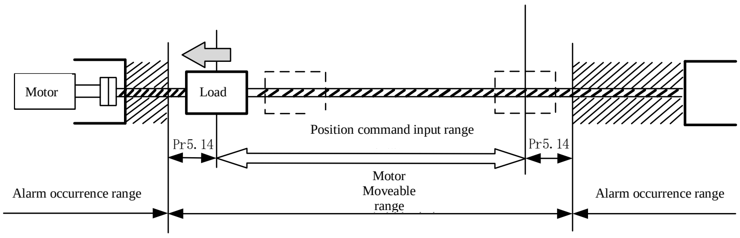


Figure 6.2.2-4 Motor moveable range protection

(4) Resetting conditions of position command input range
Position command input range will be reset in the following conditions.
When the power is switched on.
Clear the positional deviation period (the drive prohibition input is active when the deviation counter clear is valid and Pr5.05 “Timing when drive inhibit” = 2).
Control the start and end of test run through communication.

6.2.3 Fall prevention function when the alarm occurs

I. General
When servo driver gives an alarm, the vertical axis such as the mechanical arm will fall in the period from that the brake release output (BRK-OFF) is OFF to the action of the actual external brake.

This function can prevent the falling by setting the alarm time sequence as immediate stop when an alarm occurs.
This function cannot be used for alarms that do not correspond to immediate stop.
(1) Related parameters

classification	No.	Parameter name	Function
5	10	Alarm sequence	Set the state during acceleration and after stop in case of alarm. If the set value is 4~7, immediate stop takes effect.
6	10	Function extension setting	Set the related bit of fall prevention function. Positional deviation treatment of fall prevention function in case ob bit 10 alarm 0: invalid (maintained) 1: valid (cleared) When fall prevention function is valid, it should be set as 1. * The maximum bit is bit 0.

6	51	Immediate stop completion waiting time	When an alarm corresponding to immediate stop occurs, after brake release output (BRK-OFF) is OFF, the duration of continuous motor powering-on is set. When the set value=0, fall prevention function is invalid.

(2) Content

Action of fall prevention function in case that the alarm corresponding to immediate stop occurs

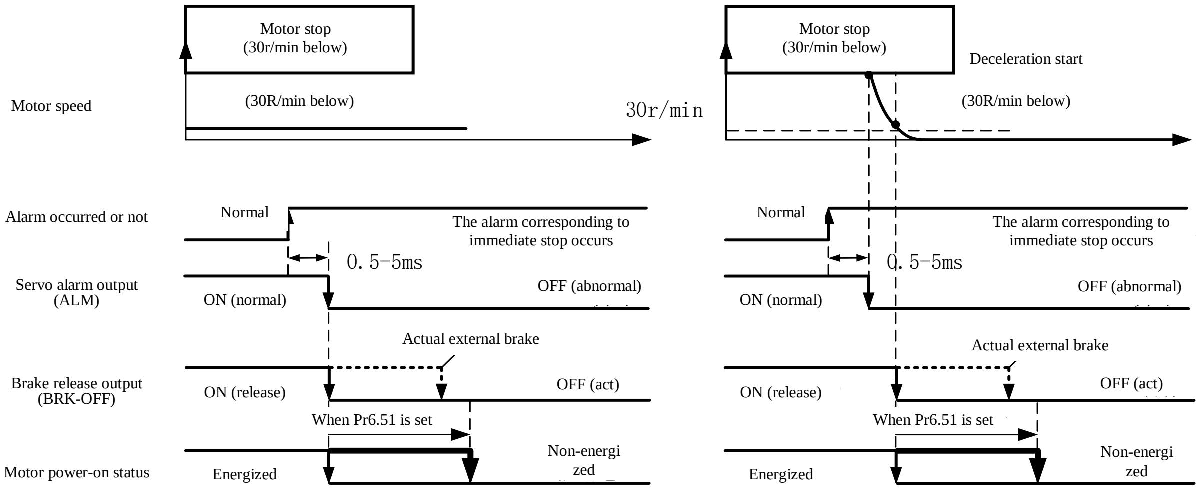


Figure 6.2.3-1 Action of fall prevention function when an alarm occurs

Note:

Under the precondition that the fall prevention function when an alarm occurs is valid, set Pr5.10 “Sequence at alarm” as "4" and bit10 of Pr6.10 “function extension setting” as "1", and set a value longer than the time from the brake release output (BRK-OFF) OFF to the action of actual external brake in Pr6.51 “immediate stop completion waiting time”.

6.2.4 Slow Stop function

When driving prohibition input, servo off, or main power off is detected or an alarm corresponding to immediate stop occurs in the setting of immediate stop, the motor can be effectively controlled and smoothly stopped under the condition that the servo is On.
Scope of application:
This function is not applicable when the following conditions are not met.

	Action conditions of Slow Stop function
Control mode	Position mode (Pr0.01=0)
Other	Servo in On state. Approximately set the elements other than control parameters like torque limitation, to make the motor rotate normally without obstacles.

6.2.5 Warning function

If the warning can be recovered in an abnormal state, it can basically be automatically recovered to the state of non-occurrence. However, as shown in the following table, warning state is still kept in the latch duration. If the warning is to be cleared in the latch duration, the same clearing procedures as for a general alarm should be performed.
In addition, When the alarm clear input (A-CLR) is valid, the warning will be cleared all the time without appearing.

Warning name	Warning number	Pr6.27 *1	Content
Overload warning	A0	○	The load rate is more than 85% of the protection level
Over-regeneration warning	A1	○	The regeneration load rate is above 85% of the grade
Battery warning	A2	Generally fixed as no time limit	Battery voltage is below 3.2V

1"○"part can be set for 1~10s with Pr6.27 "warning latch time", or it can be set as no time limit. The battery warning is in the "no time limit" state.

6.2.6 Protection function setting before gain adjustment

During gain adjustment, the product can be used more confidently by appropriately setting the following parameters according to the service conditions.
1. Drive prohibition input setting
A sudden impact to the machine end can be prevented by inputting a limit sensor signal to the driver. Please refer to the positive direction and negative direction drive prohibition input (POT/NOT) specified by the interface. In addition, please set the following driver to prohibit the input of associated parameters.
Pr5.04"Drive prohibition input setting"
Pr5.05"Drive prohibition timing sequence"
2. Torque limit setting

By limiting the maximum torque of the motor, the damage caused by mechanical collision can be reduced. Set Pr0.13 "1st torque limit"when it is required to make the same limit with parameters.
However, if it is limited to be below the actual required torque, overshoot may lead to overspeed protection or excessive positional deviation protection caused by command delay, so please pay attention to it.
In addition, the torque limit state can be detected externally by distributing the torque limit output (TLC) of the interface specification to the output signal.
3. Overspeed protection setting
Err26.0 "overspeed protection" occurs when the motor speed is abnormally high.
The factory setting is automatically set to 1.2 times of the maximum speed [r/min] of the applicable motor. If

the maximum speed of the motor is not reached under the customer's operating conditions, it is required to set Pr5.13 "Overspeed grade setting"according to the following formula.

Pr5.13"Overspeed grade setting" = Vmax × （1.2～1.5）
Vmax: The coefficient within the maximum motor speed [r/min], () under operating conditions is a safety coefficient to prevent frequent occurrence of overspeed protection.

In addition, at the initial stage of adjustment, when the motor runs at low speed, the value of this speed plus safety factor is also set, so that protection can be carried out in case of vibration.

4. Setting of excessive positional deviation protection

In the position control or full closed-loop control, when the deviation between the detected position command and the motor position is too large, Err24.0 "Excessive positional deviation protection" will occur. The excessive positional deviation grade can be set in Pr0.14 "Excessive positional deviation setting". In addition, detection can be selected from the commanded positional deviation [pulse (command unit)] and encoder position deviation [pulse (encoder unit)] through Pr5.20 "Position setting unit selection".

The factory setting is 100000 [pulse (command unit)].

The positional deviation of normal operation changes according to the speed of action and gain setting, so please set the value shown in the following formula to Pr0.14 according to the customer's operating conditions.

When Pr5.20＝0 (detection of command positional deviation)

Pr0.14"Excessive positional deviation setting" = Vc/Kp× （1.2～2.0）
Vc: Maximum frequency of position command pulse [pulse (command unit) /s]
Kp: Position loop gain [1/s]
The coefficient in () is the margin of to prevent frequent excessive position deviation protection.

Note:

1: When switching position loop gain Kp, please use the minimum value for calculation.

2: When using position command filter or vibration control, the following values should be calculated additionally.

Command smoothing filter: Vc×filter time constant [s]

Command FIR filter: Vc×filter time constant [s]/2

Vibration control: Vc /(π×vibration control frequency [Hz])

When Pr5.20= 1 (detection of positional deviation and full closed loop position deviation of encoder)

Pr0.14"Excessive positional deviation setting" = Ve/Kp×(1.2～2.0)
Ve: The highest motion frequency in encoder unit or full closed-loop unit [pulse/s]
Kp: Position loop gain [1/s]

Note:

1: When switching position loop gain Kp, please use the minimum value for calculation.

2: When Pr5.20＝1, the setting of position command filter or vibration control is not affected.

5. Motor moveable range setting

In the position control or full closed-loop control, according to the input position command range, when the rotation amount set in Pr5.14 "Motor moveable range setting" is exceeded, the motor position overshoot is detected, resulting in Err34.0 "Motor moveable range protection".

6.3 Fault cause and treatment

6.3.1 No rotation

When the motor is not running, please refer to”Display of cause of no rotation”in the Preparation chapter P.2-84

Type	Cause		Treatment
Parameter	Control mode setting error	Use the monitoring mode of front panel to confirm whether the current control mode is wrong or not?	① Reset Pr0.01. ② When Pr0.01 is 3~5, ensure that the control mode of connector CN2 is switched to the correct input (C-MODE).
	Torque limit selection error	As torque limit, whether an external analog input is used (N-ATL/P-ATL)?	① To use external input, let Pr5.21 be 0, and apply-9 [v] to N-ATL and+9 [v] to P-ATL. ② When using parameter values, set Pr5.21 as 1 and set the maximum value at Pr0.13.
	Command pulse frequency division and multiplication Setting error (Position, full closed-loop)	Does the motor act according to the predetermined movement amount for the command pulse input?	① Re-confirm the settings of Pr0.09, 0.10, Pr5.00~Pr5.02. ② The command frequency division switching input (DIV) of connector CN2 is connected to COM－, pr0.09 and 5.00 are set as the same value, and frequency division switching is invalid.
Wiring	Connector CN2 servo enabling On input (SRV-ON) disconnected.	Is pin No. corresponding to SRV-ON in monitoring mode of front panel in “—” state?	Connect SRV-ON force to COM－,confirm the input signal, and conduct wiring.
	Positive/negative direction drive prohibition input (NOT/NOT) of connector CN2 is disconnected.	Is pin No. corresponding to NOT/POT in monitoring mode of front panel in “A” state?	① Connect NOT/POT to COM－, confirm the input signal, and conduct wiring. ② Set Pr5.04 as 1 (invalid), and restart the power supply.
	Command pulse input Setting error (Position, full closed-loop)	Is there an offset in the change between the number of input pulses and the sum of command pulses in the monitoring mode state of the front panel?	① Confirm whether the command pulse is input correctly through PR 0.05 selection. ② Confirm the command pulse input under the condition that Pr0.07 is set.
	Connector CN2 command Pulse prohibition input (INH) disconnected. (Position, full closed-loop)	Is Pin No. of INH in monitoring mode of front panel in “A” state?	① Connect INH input to COM-,confirm the input signal, and conduct wiring. ② Pr5.18 is set as 1 (invalid).
	Connector CN2 counting clear input (CL) is connected to COM－. (Position, full closed-loop)	Is Pin No. of CL in monitoring mode of front panel in “A” state?	① Disconnect CL input ,confirm the input signal, and conduct wiring. ② Pr5.17 is set as 0 (invalid).
	Speed command is invalid. (Speed)	Is there any error in speed command input method (external analog command internal speed command)?	① When using the external simulation instruction, set Pr3.00 as 0, and then confirm the setting of Pr3.02~3.03. ② When using the internal speed command, set Pr3.00 as any one of 1~3, and then set

			Pr3.04~3.07, r3.08~Pr3.11.
	The zero speed clamp (ZEROSPD) input of connector CN2 is disconnected. (Speed Torque)	Is Pin No. of ZEROSPD in monitoring mode of front panel in “A” state?	①Connect zero speed clamp input to COM-, confirm the signal input and wiring. ②Pr3.15 is set as 0 (invalid).
	Torque command is invalid. (Torque)	Is there any error in the torque command method (SPR/TRQR input, P-ATL/TRQR input)?	① To use SPR/TRQR input, set Pr3.17 as 0 and confirm whether the voltage can be applied normally. ② To use P-ATL/TRQR input, set Pr3.17 as 1 and confirm whether the voltage can be applied normally.
	Speed control is invalid. (Torque)	Is there any error in speed limit input method (speed, SPR/TRQR/SPL input)?	① When using parametric speed, set Pr3.17 as 0 and set Pr317 as the expected maximum value. ② To use SPR/TRQR/SPL, set Pr3.17 as 1 and confirm whether the voltage can be applied normally.
Setting	The main power supply is disconnected.	Is Pin No. of S-RDY in monitoring mode of front panel in “—” state?	Confirm the wiring and voltage of the main power supply (L1, L2, L3) of the driver.
	The motor output shaft is too heavy to rotate.	① Is it possible to rotate the motor manually after cutting off the power supply of the driver and removing the motor from the equipment? ② Can the motor with holding brake be rotated manually when DC24V voltage is applied to the brake?	When the motor cannot be rotated, contact the agent to repair the motor.

6.3.2 Unstable (unsteady) rotation, slow rotation under speed control mode and zero speed

Type	Cause	Treatment
Parameter	Control mode setting error	When the set value of Pr0.01 is set as 1 in position control mode (speed control mode), if the servo is turned on, there is a slow rotation due to speed command offset, so it is necessary to change the setting of Pr0.01 to 0 (position control mode).
Adjustment	Poor gain adjustment	Improve the set value of the 1st speed loop gain Pr1.01. Set the torque filter Pr1.04, and then increase the set value of Pr1.01 again.
	Speed and position commands are unstable	Use the oscilloscope function of upper computer Ω Master to confirm motor operation. Reconfirm the wiring and controller, and confirm whether the connector is in poor contact.
Wiring	The input signal of connector CN2 fluctuates. ① Servo enabling On signal ② Forward/reverse torque limit input signal ③ Deviation count input signal ④ Zero-speed clamp signal	① The wiring between the pins 29 and 41 of terminal CN2 is confirmed through the display function of the input and output signal status. Repair wiring and connection, so that the servo enabling On signal can be turned on normally. Inspect the controller again. ② The wiring between the pins 28, 17 and 16 of terminal CN2 is confirmed through the oscilloscope for testing connection. Repair wiring and connection, so that the positive/negative direction torque limit can be input normally. Inspect the controller again. ③ Confirm the wiring and connection between the pins 30 and 41 of terminal CN2 through the display function of the input and output signal status. Repair wiring and connection, so that deviation count input can be normally connected. Inspect the controller again.

	⑤ Command pulse prohibition input signal	④ Make a confirmation by use of the display function of input and output signal status of wiring and connection between the pins 26 and 41 of terminal CN2. Repair wiring and connection, to make zero speed clamp is input normally. Inspect the controller again. ⑤ Make a confirmation by use of the display function of input and output signal status of wiring and connection between the pins 33 and 41 of terminal CN2. Repair wiring and connection, so that the command pulse prohibition input can be turned on normally. Inspect the controller again.
	Noise in speed command	The cable of connector CN2 is a shielded wire. The power line and signal line are separated (more than 30cm away) and installed in the conduit.
	Zero drift compensation offset	Check the voltage between pins 14 and 15 of the speed command input of terminal CN2 with an oscilloscope or multimeter.
	Position command is disturbed	The cable of connector CN2 is a shielded wire. The power line and signal line are separated (more than 30cm away) and installed in the conduit.

6.3.3 Poor positioning accuracy

Type	Cause	Treatment
System	position command error. (Command pulse quantity)	Through the monitoring function of the testing software Ω Master, the feedback pulses are counted after repeated round trips at equal distances. Adjust the controller when the same value cannot be returned. Implement the anti-interference countermeasures for command pulse.
	The reading method of positioning completion signal is edge reading.	Use the oscilloscope function of testing software Ω Master to monitor the deviation when positioning completion signal is received. The control signal should be read in a time width manner instead of an edge manner.
	The shape and width of the command pulse are inconsistent with the specification.	If the command pulse is deformed and narrowed, it is necessary to adjust the pulse generating circuit. Take anti-interference measures again.
	The deviation counting clear input CL (connector CN2 30Pin) is disturbed.	When anti-interference measures are implemented, unused signal lines are not wired.
Adjustment	Position loop gain is too small.	Confirm the position deviation with the monitoring function of testing software Ω Master. Improve the set value of Pr1.00 within the range of not causing oscillation.
Parameter	The positioning end range is set too large.	In the range where the end signal does not fluctuate, the set value of the positioning end range Pr4.31 is reduced.
	Command pulse exceeding 500kpps or 4Mpps	Reduce the command pulse frequency. Change the frequency division/multiplication ratio of Pr0.09 and pr 0.10. When differential input is used, a special interface driven by a long line should be used.
	Frequency division/multiplication setting error.	Check whether it is the same as the actual required value.
	Upon stop, the speed loop only acts with proportional gain.	Set the 1st speed loop integration time constant Pr1.02 and the 2nd speed loop integration time constant Pr1.07 to 9999 or less. When Pr1.14 is set as 1 in the 2nd gain, the connection between pins 24 and 41 of the gain switching input terminal CN2 should be ensured to be closed, and the wiring and connection should be corrected. Moreover, inspect the controller again.

Wiring	Each signal input of connector CN2 fluctuates. ① Servo enabling signal ② Deviation counter resetting input signal ③ Forward/reverse torque limit input signal ④ Command pulse prohibition input signal	① The wiring and connection between the pins 29 and 41 of terminal CN2 are confirmed through the display function of the input and output status. Repair wiring and connection, so that the servo enabling signal can be turned on normally. Inspect the controller again. ② The wiring and connection between the pins 30 and 41 of terminal CN2 are confirmed through the display function of the input and output status. Repair wiring and connection, so that deviation counting clear input can be normally connected. Inspect the controller again. ③ The wiring and connection between the pins 18 and17, 16 and 17 of terminal CN2 is confirmed through the oscilloscope. Repair wiring and connection, so that the positive/negative direction torque limit can be input normally. Inspect the controller again. ④ The wiring and connection between the pins 33 and 41 of terminal CN2 are confirmed through the display function of the input and output signal status. Repair wiring and connection, so that the command pulse prohibition input can be turned on normally. Inspect the controller again.
Setting	Excessive load inertia ratio	Use the testing software Ω Master to confirm the overshoot upon stop through the waveform diagram. When the adjustment gain can not be repaired, it is required to increase the capacity of motor and driver.

6.3.4 Abnormal noise and vibration of the motor

Type	Cause	Treatment
Wiring	Position command is disturbed	Measure the waveform between the speed command inputs 14 and 15 of terminal CN2 with an oscilloscope. Take countermeasures to reduce interference, for example, installing anti-interference filter, connecting ferrite magnetic ring, adding shielding layer to interface cable, using twisted pair, and running signal line and power line separately.
Adjustmen t	The gain is set too large.	The set values of speed loop gains Pr1.01 and 1.06 and position loop gains Pr1.01 and 1.06 decrease, thus reducing the gain.
Installation	Resonance between equipment (machinery) and motor.	Set Pr1.04 and Pr1.09 before readjusting. Use the waveform analysis function of testing software Ω Master to observe whether there is mechanical resonance. If there is mechanical resonance, set the notch frequencies Pr2.01, 2.04, 2.07, 2.10 and 2.24
	Motor bearing.	Confirm the sound and vibration near the bearing through no-load driving. Make a reconfirmation after replacing the motor. Entrusted repair.
	Electromagnetic sound, gear sound, friction sound during brake operation, wheel hub sound and friction sound at encoder.	Make a confirmation through no-load driving, and a reconfirmation after replacing the motor. Entrusted repair.

6.3.5 Overshoot/undershoot, motor overheating (motor burning)

Type	Cause	Treatment
Adjustment	Poor gain adjustment	Confirm the oscillogram status through testing software Ω Master. Adjust the gain correctly. Refer to chapter"Adjustment".
Installation	Excessive load inertia	Confirm the oscillogram status through testing software Ω Master. Adjust the gain correctly. Increase the capacity of motor and driver and lower the inertia ratio. Use a speed reducer.
	Shaking and sliding of equipment (machine)	Adjust the installation position of equipment (machine).
	Operating temperature and environment	When the operating temperature exceeds the stipulated value, a cooling fan should be installed.
	Cooling fan stop, fan vent blocking	Inspect the equipment cooling fan and the driver fan. The cooling fan of the driver which needs to be replaced should be repaired in time.
	Driver unmatched	Confirm the nameplate of driver and motor. Make a correct combination according to instructions or catalogue.
	Motor bearing fault	Cut off the power supply, rotate the shaft in the single motor state, and confirm whether there is any abnormal noise. In case of abnormal noise, replace the motor and send it for repair in time.
	Keep the brake on all the time (Forgot to release the brake)	Confirm the voltage of the brake terminal. Apply power (DC24 V), and release the brake.
	Motor fault (oil, water, others)	Avoid high-temperature and high-moisture places, or any environment with dust or excessive iron powder.
	When the dynamic brake is in operation, confirm the action model, service condition and operation condition	by driving the motor with external force. Please do not use in such environment.

6.3.6 The rotation speed does not rise to the set speed, and the rotation amount (movement amount) is too large or too small

Type	Cause	Treatment
Parameter	Speed command input gain setting error	Confirm whether the speed command input gain is approximate or not. For example, when Pr3.02 is set as 500, it is 3000r/min/6V.
Adjustment	Low position loop gain	Set the 1st position loop gains Pr1.00 and Pr1.0 at about 1000.
	Improper frequency division/multiplication	Set the values of the 1st command frequency division/multiplication numerator Pr0.09, the number of output pulses per revolution Pr0.11 and the command frequency division/multiplication denominator Pr0.10 correctly. Please refer to parameter settings.

Chapter 7 Full-closed loop control

7.I General

The full closed-loop control mode is to use an external displacement sensor to directly detect the position of the controlled object for feedback and position closed-loop control, so that the control system can not be affected by the error of intermediate transmission element and the position change caused by temperature. However, the full closed-loop control mode will also lead to unstable positioning and vibration due to looseness or torsion of the controlled equipment. Diagram is shown as below:

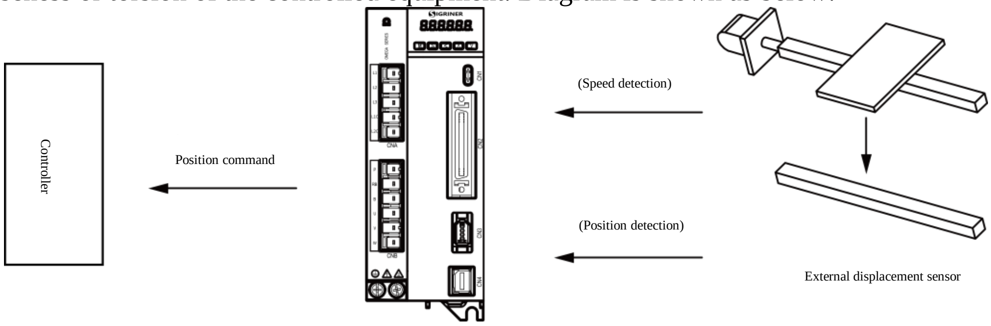


Figure 7.1-1 Full-closed loop control diagram

7.1.1 Full-closed loop control mode diagram

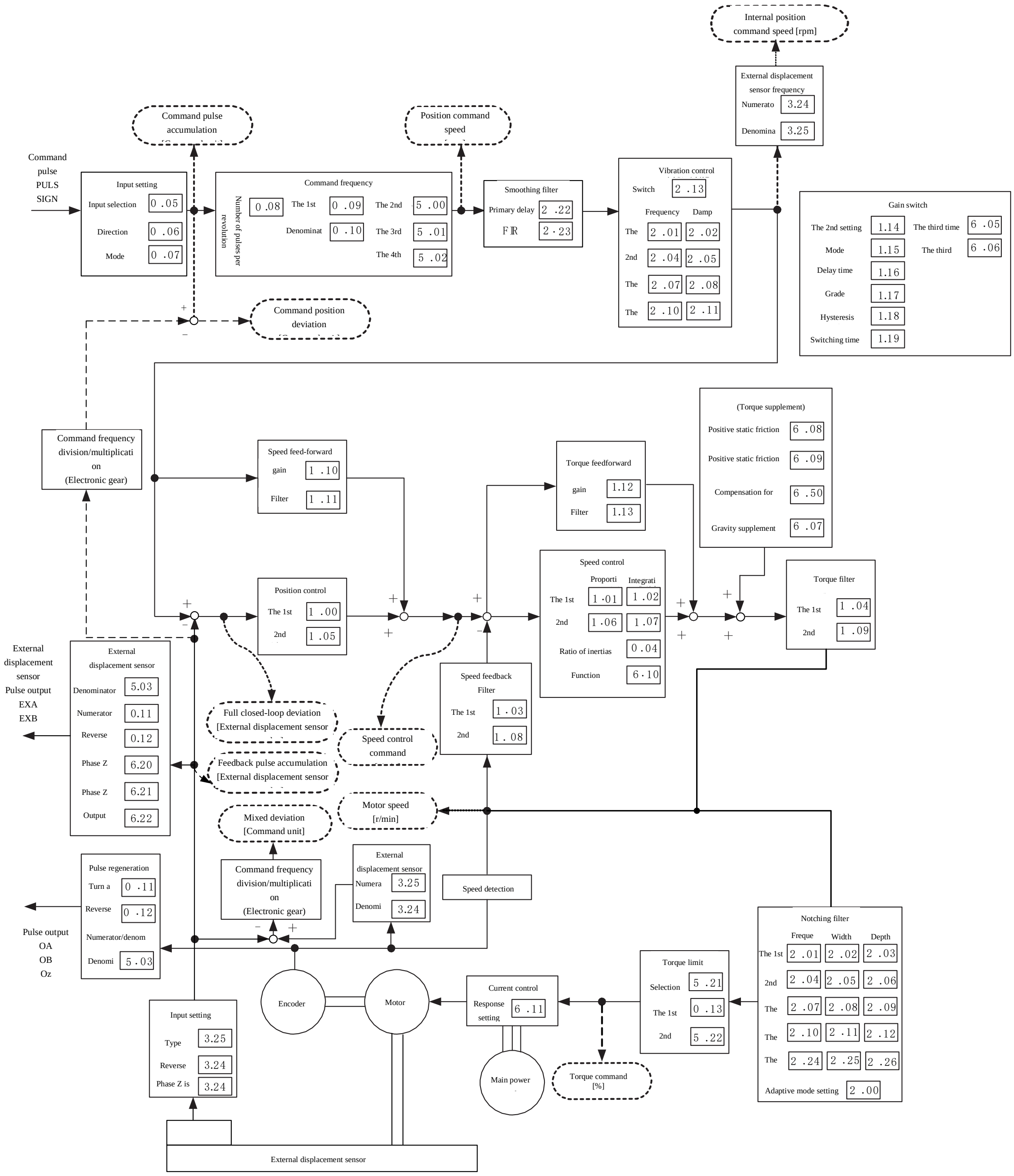


Figure 7.1.1-2 Full-closed loop control mode

7.1.2 Parameter description

Parameter number	Parameter name	Parameter description
Pr3.23	External displacement sensor type selection	0-AB phase output type (currently only such type supported)
Pr3.24	Frequency division numerator of external displacement sensor	When the set value is 0, the encoder resolution is used as a frequency division numerator.
Pr3.25	Frequency division denominator of external displacement sensor	Pr3.24/Pr3.25 = encoder resolution [pulse] per rotation of motor/resolution [pulse] of external displacement sensor per rotation of motor
Pr3.26	Reversal of external displacement sensor direction	0- Non-reverse 1- Reverse rotation
Pr3.27	Invalid detection setting for phase Z disconnection of external displacement sensor	0- Valid 1- Invalid
Pr3.28	Excessive mixing deviation setting	The allowable difference (mixed deviation) between the position of the motor (encoder) and the position of the load (external displacement sensor) is set by the command unit
Pr3.29	Mixed deviation clearing setting	Clear the mixing deviation every time when the number of motor rotation circles reaches the set value. Mixing deviation is not cleared when the set value is 0.

7.2 Operating steps

7.2.1 Full-closed loop mode

1. Set Pr0.01 as full closed-loop mode and Pr3.23 as 0 before restart. Skip this step if the homeal mode is full closed-loop;
2. Set Pr3.27 as 1 in case of power-on alarm Err50.0;
3. Increase Pr3.28 approximately (for example: 100) in case of power-on alarm Err25.0;
4. Pull out the motor power line, move the controlled element to one end, and use an oscilloscope to monitor the position of 57-external encoder and 59-main encoder. Set Pr3.26 to another value if the two curves do not increase and decrease at the same time;
5. Set the values of Pr3.24 and Pr3.25, and restart after setting to start full closed-loop control.

For example: The resolution of the magnetic grid is 0.001mm, the screw rod moves 5mm when motor rotates one turn, the feedback increment is 5/0.001=5000inc, and Pr3.24=0 and Pr3.25=5000 are set.

7.2.2 Full-closed loop to semi-closed-loop switching mode

1. Set according to steps 1~4 in 3.1.
2. Modify Pr0.01 to position mode
3. Assign and input an IO as the switching signal source according to the following table

Signal name	Signs	NO	NC
Full-closed-loop switching input	FUL	2Dh	ADh

Restart the driver after setting to enable the full-closed loop to semi-closed-loop switching mode.

Chapter 8 Safety functions

8.1 Outline

Ω6 series servo is provided with safe torque off (STO) function to ensure that when STO input is used correctly according to IEC61800 -5-2, torque generated electric energy can be prevented from being transmitted to the motor. STO can be requested or triggered when there is an error. The built-in STO function does not cut off the connection between the motor and the power supply, but prevents the generation of rotating magnetic field from by disconnecting the control connection with the power device.
Ω6 is provided with three optocouplers, in which, two are used for STO signal input and one for STO signal output state monitoring, and STO output does not participate in safety control. When the STO function is triggered, the control core will turn off the PWM driving signal of the power gate driver IC, and the isolated gate bipolar transistor (IGBT) will be disabled, thus disabling the power generated by torque. Safety circuit block diagram is shown as below.

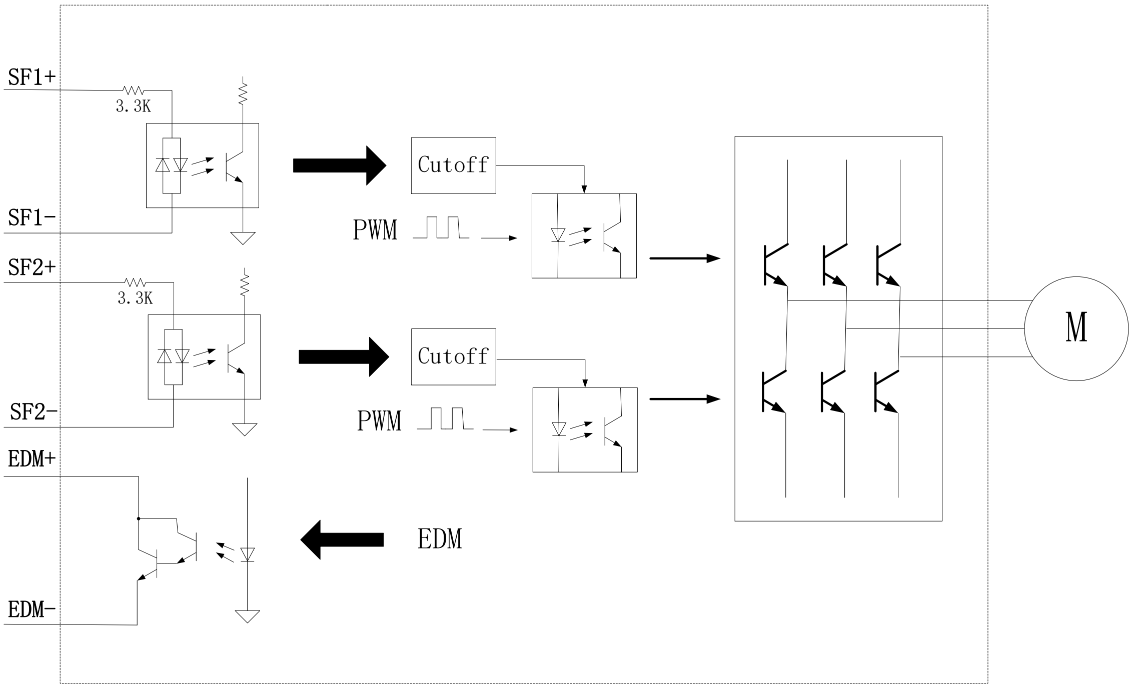


Figure 8.1-1 Safety circuit block diagram

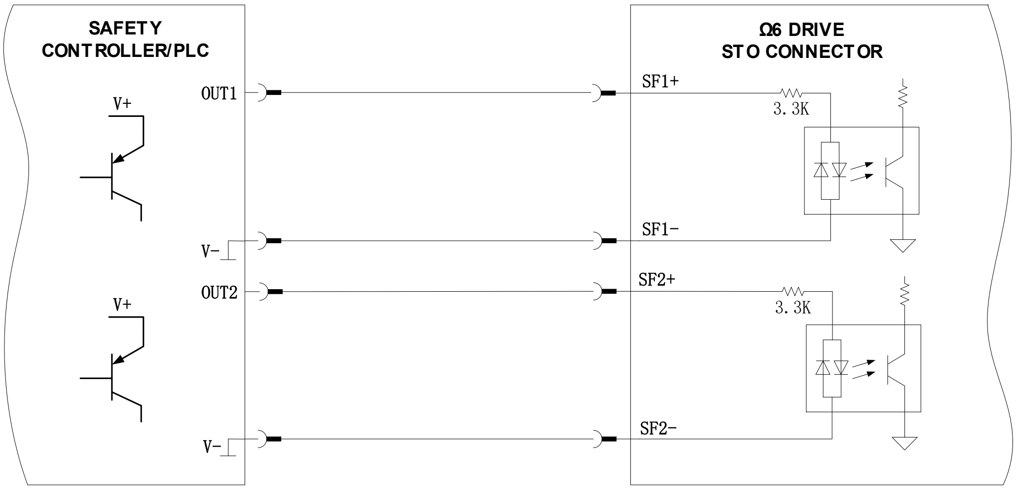
When any STO input signal is in an invalid (off) state, the control core will turn off the PWM drive signal to prohibit torque from generating electricity. Only when both STO input signals are valid (turned on), the control core can be activated and the running function of the motor will be restored again.

8.2 Input/output signal

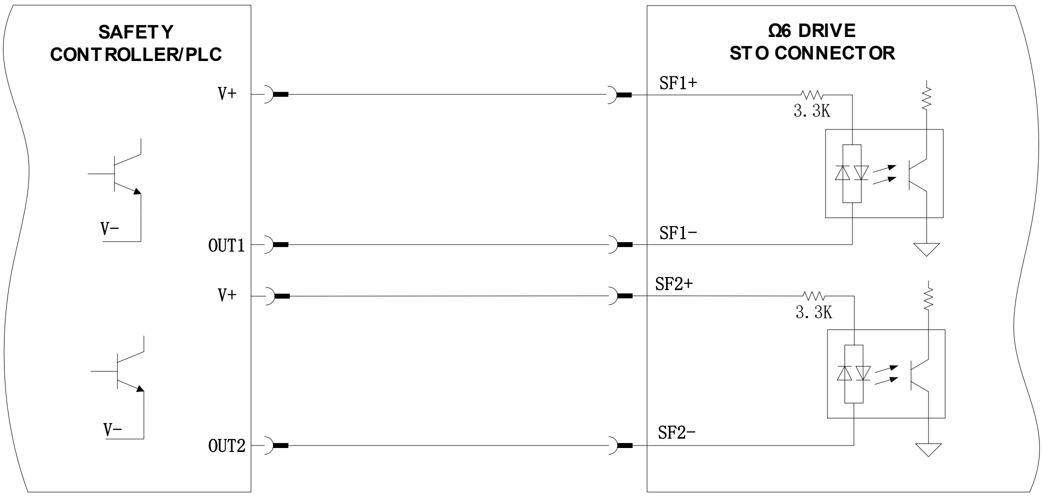
Name	Signs	Connector pin No.	Content
	NC	1	Please do not connect any equipment
	NC	2	Please do not connect any equipment
STO safety input 1	SF1-	3	For two sets of systems with independent circuits, close the driving signal of power module, to cut off the power supply
	SF1+	4	
STO safety input 2	SF2-	5	
	SF2+	6	
STO EDM output	EDM-	7	For the monitoring output of monitoring safety function failure
	EDM+	8	

8.3 Safety circuit block diagram

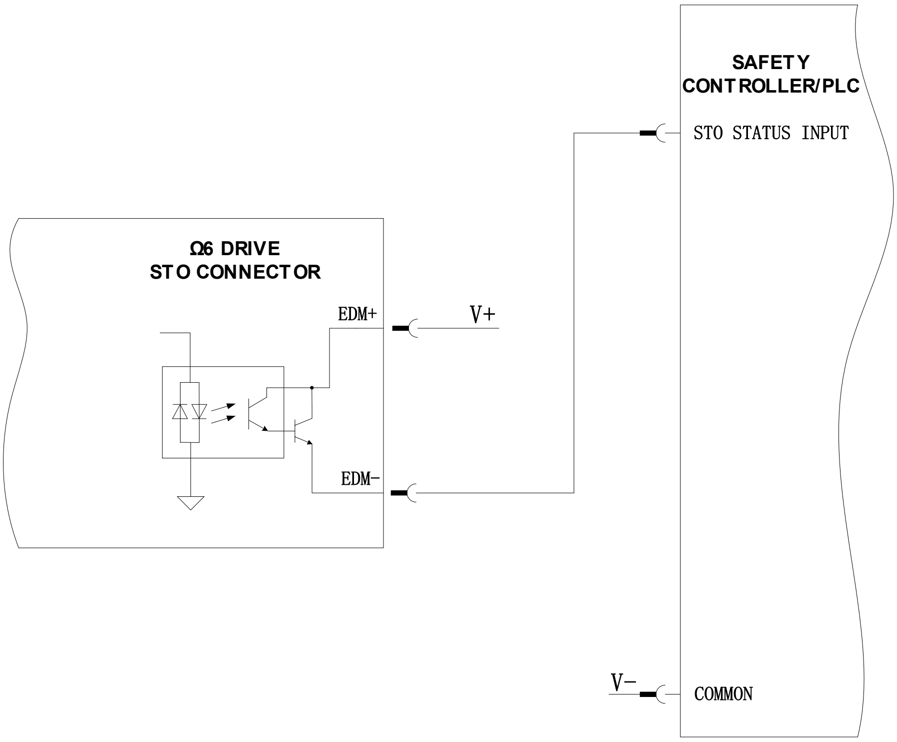
STO input—PLC high-edge digital drive mode



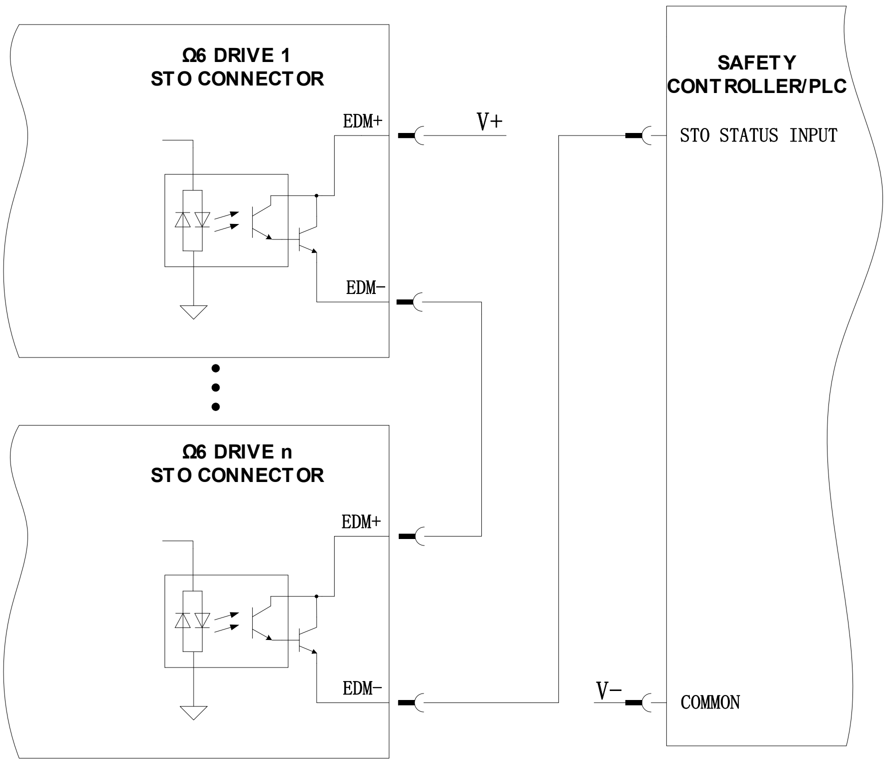
STO input—PLC low-edge digital drive mode



STO output connection—single-shaft



STO output connection—multiple-shaft



STO output status indication

STO output indicates the current status of STO, which is used for the diagnosis of upper computer or client side. The functional logic table of STO output is shown as below.

STO safety input 1	STO safety input 2	STO EDM output
OFF	OFF	ON

OFF	ON	ON
ON	OFF	ON
ON	ON	OFF

Action timing diagram of STO status

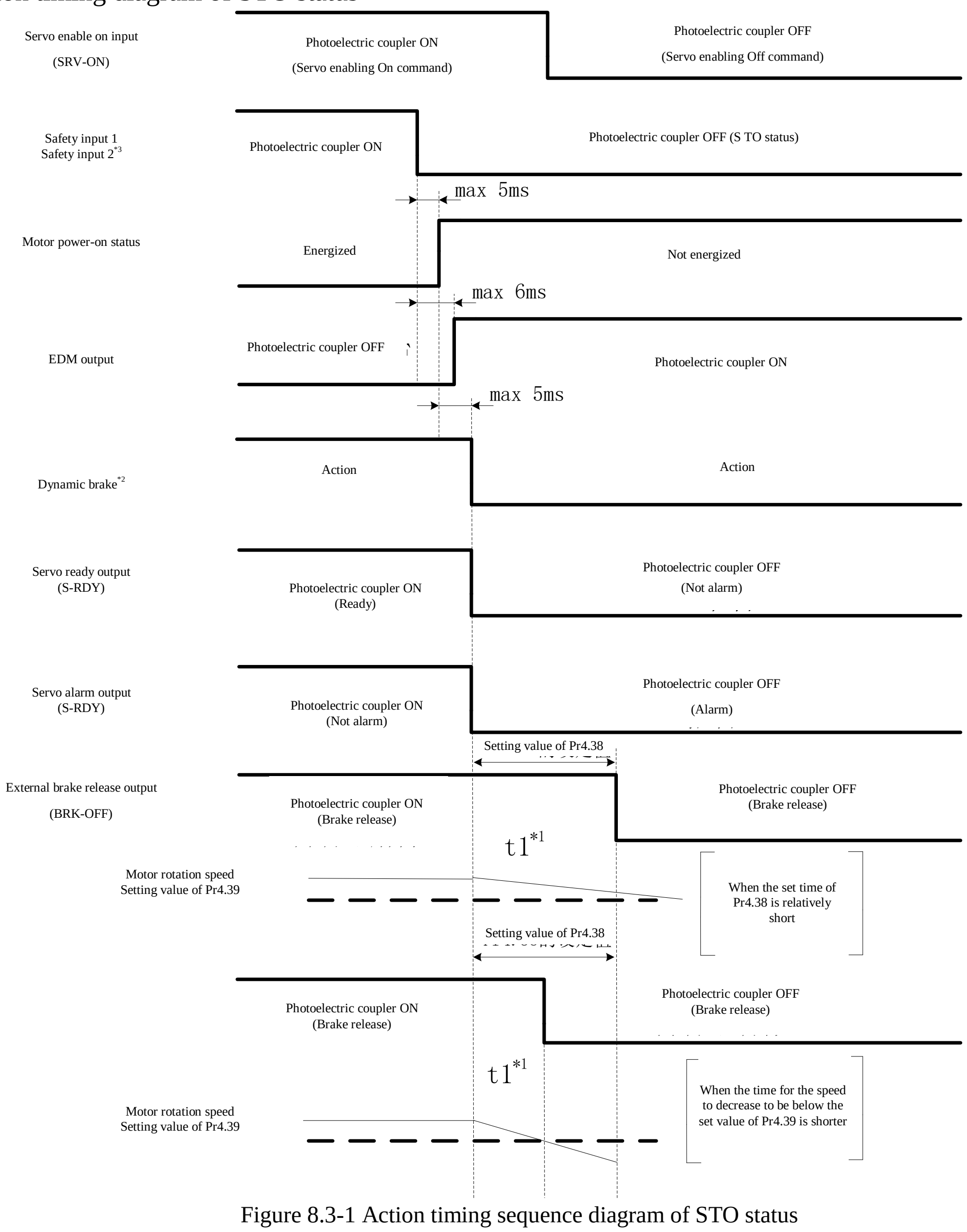


Figure 8.3-1 Action timing sequence diagram of STO status

＊1. T1 is the set value of Pr4.38 “Mechanical brake action setting during action” and the set time of time taken for the motor rotation speed to fall below the speed set in Pr4.39 “Brake release speed setting”, whichever is shorter.

＊2. The dynamic brake is subject to the setting of Pr5.10 “Alarm time sequence”. (“Alarm time sequence” is also applicable even if no alarm occurs in STO status).

＊3. When STO function is turned on, please turn off safety inputs 1 and 2 at the same time.

＊4. After the motor is powered off, it will fall down when it is vertical to the shaft due to unavailable servo lock until the external brake acts. Be careful not to cause such problems when activating the external brake.

Reset timing sequence diagram of STO status

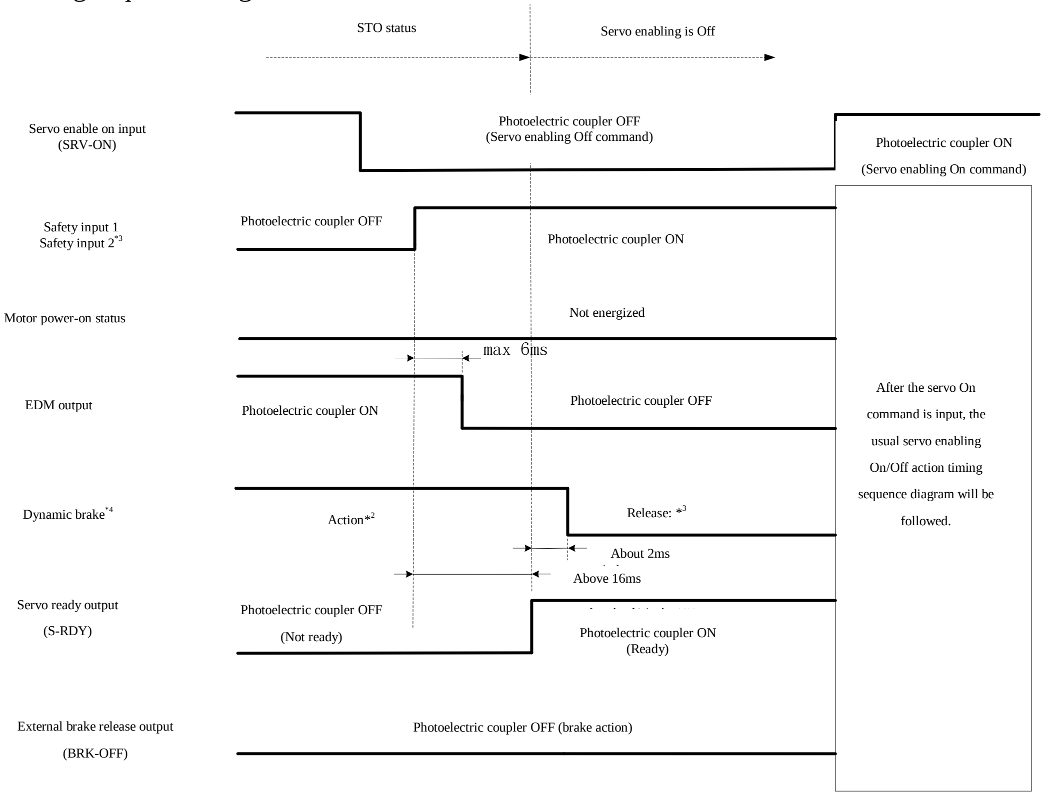


Figure 8.3-2 Reset timing sequence diagram of STO status

＊1. Make sure that the photoelectric couplers of safety inputs 1 and 2 can return to ON when the servo enabling input is turned on. When the couplers of safety inputs 1 and 2 return to ON, they will automatically reset to the servo enabling Off state. (No need for alarm clearing)

＊2. This is an state of alarm occurrence, and the dynamic brake complies with Pr5.10 “Alarm time sequence”. (“Alarm time sequence” is also applicable even if no alarm occurs in STO status).

＊3. This is an state of serve Off, and the dynamic brake complies with Pr5.06 “Servo Off timing sequence”.

Chapter 9 Data

9.1 Upper computer testing software "Ω Master"

Operating environment required for testing software
Ω Master servo testing software needs to be installed on Windows® operating system to communicate with Ω series servo drivers. A computer is connected with the driver by Typ-C line.

Note:
Windows®Windows® is a registered trademark or trademark of Microsoft Corporation in the United States and or other countries.
[Necessary installation environment]

Table 1 Personal computer

OS system	Windows®XP (32bit version, 64bit version) Windows®7 (32bit version, 64bit version) Windows®8 (32bit version, 64bit version) Windows®10 (32bit version, 64bit version)
CPU grade	Pentium III 512MHz above
Memory requirements	Above 10GB
Hard disk capacity requirements	The installation capacity should be more than 200MB
Serial communication function	USB communication port
OPenGL version	OpenGL version 3.5 above

Table 2 Display parameters

Screen resolution	1024×768 pixels above
Color quality	24 bit color (TrueColor) above

①The customer must have Windows® operating system.
②Special attention should be paid to that this software does not support operating systems.
③Attention should be paid to that the latest version of Omega Master should be used in the Windows® operating system.
④Please use a shielded Type-C interface cable, otherwise abnormal data may be caused due to the impact from motor.

9.1.1 Start of Ω Master software

1. Power on the computer and driver, to start Windows.
2. Open the software package and find the Ω Maste.exe application file.
3. Double click the Ω Maste.exe

9.1.2 Close of Ω Master servo software

1. Click  on the top right of the interface to close the testing software.

9.2 Absolute system

9.2.1 Battery installation

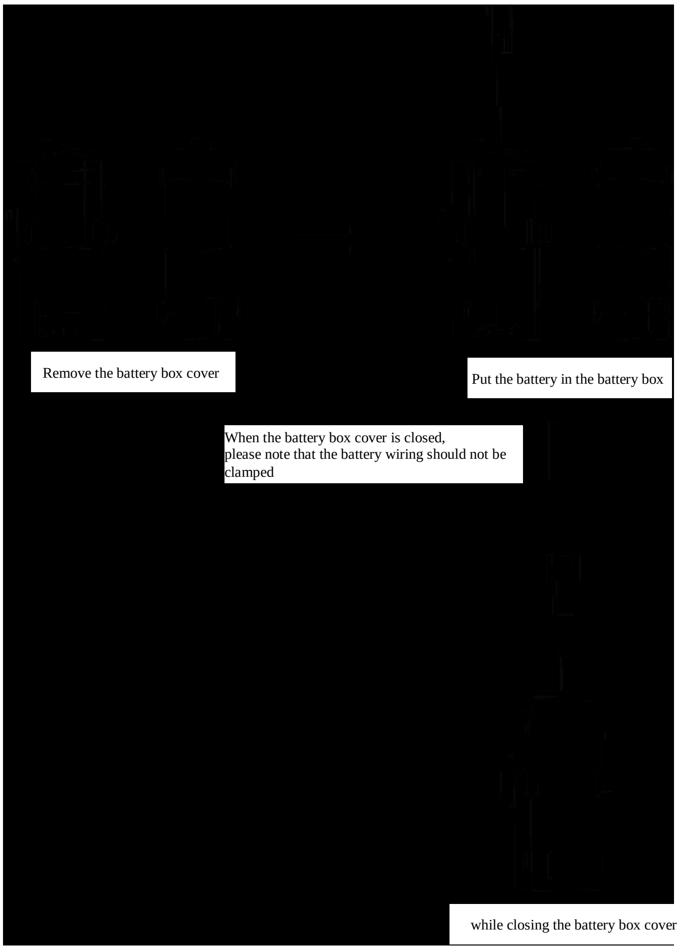
9.2.1.1 During the 1st installation of battery

Connect the absolute encoder battery to the motor, and then set the absolute encoder. Please refer to the installation (initialization) of absolute encoder.

9.2.1.2 During the replacement of battery

In case of battery warning, the absolute encoder battery should be replaced.
The battery should be replaced under the condition that the driver control power is On. In case of replacement of battery when the driver control power is Off, the multiturn data in the encoder may be lost. Please pay attention to this.
After replacement of absolute encoder battery, battery warning should be cleared. Please refer to battery warming clear method for the clear method.

9.2.1.3. Battery installation method



If the battery is used incorrectly, it may result in product corrosion due to battery liquid leakage or result in dangerous situations such as battery rupture, so please observe the following items.
1. Place the + and **-** directions correctly.
2. If a battery that has been used for a long time or can no longer be used is placed in the machine, it may cause liquid leakage, etc. Please replace such battery as soon as possible. (Reference period: Replacement is

recommended once a year.)
Battery electrolyte is highly corrosive, which will not only corrode the surrounding parts, but also has the danger of short circuit due to its conductivity. Therefore, please replace the battery regularly.
3. Do not disassemble the battery or throw the battery into a fire.
It is very dangerous for scattered objects to enter eyes, so do not disassemble it. In addition, if the battery is put into fire or heated, it may result in a risk of rupture.
4. Do not short-circuit the battery and never peel off the battery sheath.
If the + and **-** terminals of battery contact metal, a large current will flow out at one time. The battery will have a weak electricity, and also it may be ruptured due to severe heating.
5. This battery cannot be charged. Never charge it.
Local governments may have different regulations on the disposal of replaced batteries, and the replaced batteries should be disposed of according to the regulations of local governments.

9.2.1.4 Battery service life

EVE battery ER14505 is recommended, with a nominal voltage of 3.6V and a nominal capacity of 2700mAh.
The service life of the battery is related to its actual operating conditions, and it should be calculated based on the following operating conditions:
Battery capacity 2700mAH;
Number of battery connected motor encoders: 1 shaft;
Motor type: OM1 series;
Servo working time: 8 hours/day;
Battery ambient temperature during servo operation: 60℃ (assuming the battery is under the driver);
Battery self-discharge during servo operation: 8.2uA;
Servo stop working time: 16 hours/day;
Battery ambient temperature when servo stops working: 20℃;
Battery self-discharge when servo stops working: 2.7uA;
Current consumed by encoder when servo stops working: 10uA;

Annual battery consumption capacity:
[8h×8.2uA+16h×(10uA+2.7uA)]×365天 = 98.1mAh/year
Therefore, the battery service life:
2700mAh÷98.1 mAh/year = 27.5 years
Note:
The above is only theoretical calculation, without considering the environmental change factors other than battery loss and calculation conditions.

9.2.2 Installation (initialization) of absolute encoder

Multiturn data of absolute data is stored by the battery for absolute encoder. Therefore, after the battery for absolute encoder is installed, when the machine is started for the 1st time, it is necessary to clear the encoder at the home position and reset the multipleturn data. Clear the absolute encoder through the front panel. During clearing, please disconnect the control power and then reconnect it.

9.2.3 Transmission of absolute data

Absolute data can be sent and received using RS485 according to modbus protocol, and the corresponding address contents are as follows

Register address	Register name	Register quantity	Content
4202h	Encoder single turn data-L	2	Encoder single turn data-L
	Encoder single turn data-M		Encoder signal turn data-M
	Encoder single turn data-H		Encoder single turn data-H
4204h	Encoder single turn data-L	1	Encoder single turn data-L
	Encoder single turn data-H		Encoder single turn data-H

Single turn data 🡄 encoder single turn data-H x 10000h encoder single turn data-M x 100h +encoder single turn data-L

Multiturn data 🡄 encoder multiturn data-H x 100h+multiturn data-L

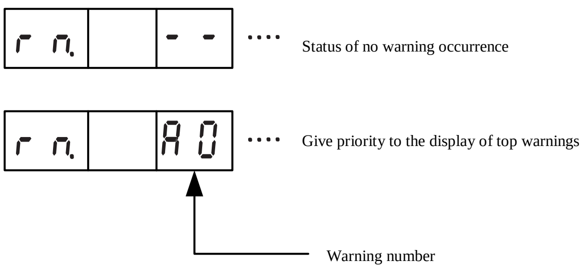
Absolute data composition of external displacement sensor can be sent and received using RS485 according to modbus protocol, and the corresponding address contents are as follows

Register address	Register name	Register quantity	Content
420Ah	External scale data (Lower 24bit)-L	2	External displacement sensor data (lower 24 bit)-L
	External scale data (Lower 24bit)-M		External displacement sensor data (Lower 24bit)-M
	External scale data (Lower 24bit)-H		External displacement sensor data (lower 24 bit)- H
420Ch	External scale data (Upper 24bit)-L	2	External displacement sensor data (Upper 24 bit)-L
	External scale data (Upper 24bit)-M		External displacement sensor data (Lower 24bit)-M
	External scale data (Upper 24bit)-H		External displacement sensor data (lower 24 bit)- H

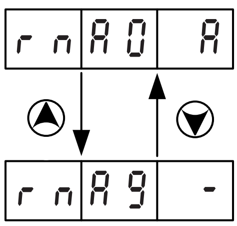
Absolute data of external displacement sensor
🡄External displacement sensor data (Lower 24 bit)-L
+ External displacement sensor data (Lower 24bit)- M x 100h
+ External displacement sensor data (Lower 24 bit)- H x (10000h)
+ External displacement sensor data (Upper 24 bit)-L x (1000000h)
+ External displacement sensor data (Upper 24 bit)- M x 100000000h
+ External displacement sensor data (Upper 24 bit)- H x 10000000000h
Absolute data of external displacement sensor is 48 bit (A negative value represents a complement of 2)

9.2.4 Display of battery warning

If the front panel is in the warning execution mode of monitor mode, the following warning will be displayed.



■Press key, and the occurrence of each warning will be displayed.



■Type of warning

Warning number	Warning name	Content
A0	Overload warning	The load rate is more than 85% of the protection level
A1	Over-regeneration warning	Regenerative load rate is more than 85% of the protection level
A2	Battery warning	Battery voltage is lower than normal

9.3 Outline dimension drawing

9.3.1 Driver

[Unit: mm]

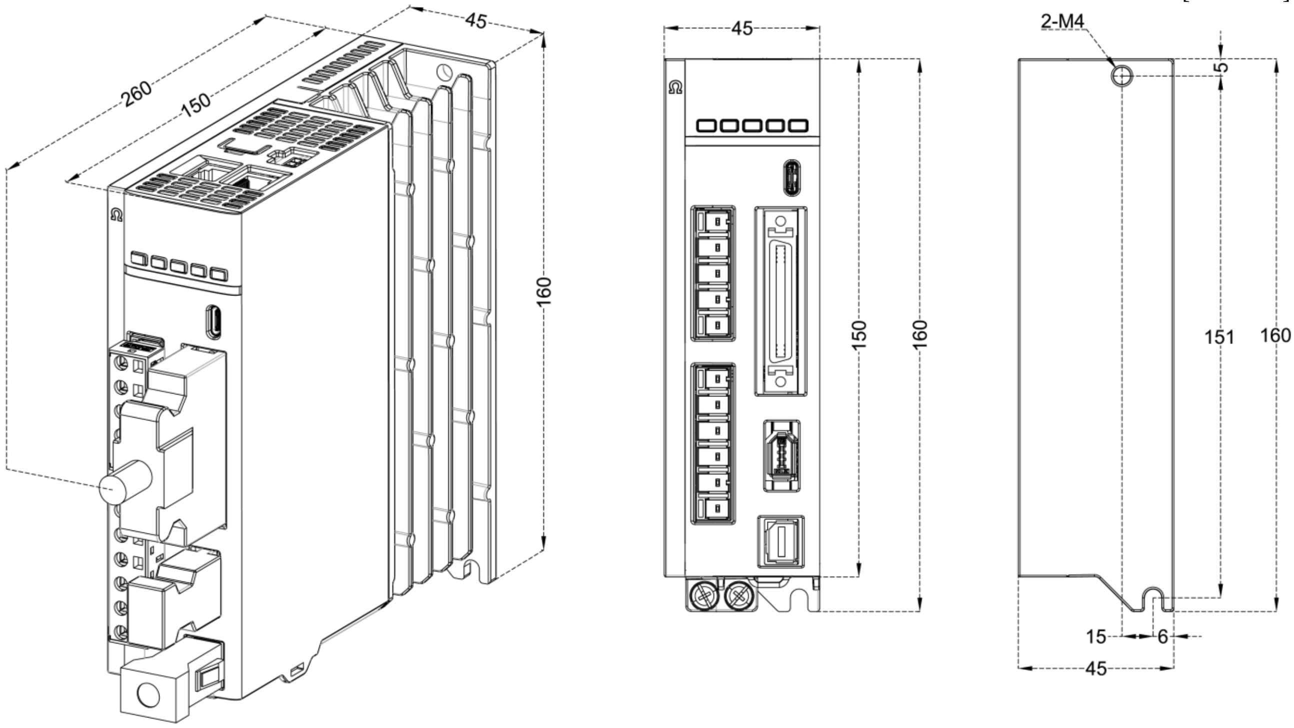


Figure 9.3.1-1 Outline dimension drawing of type A driver

[Unit: mm]

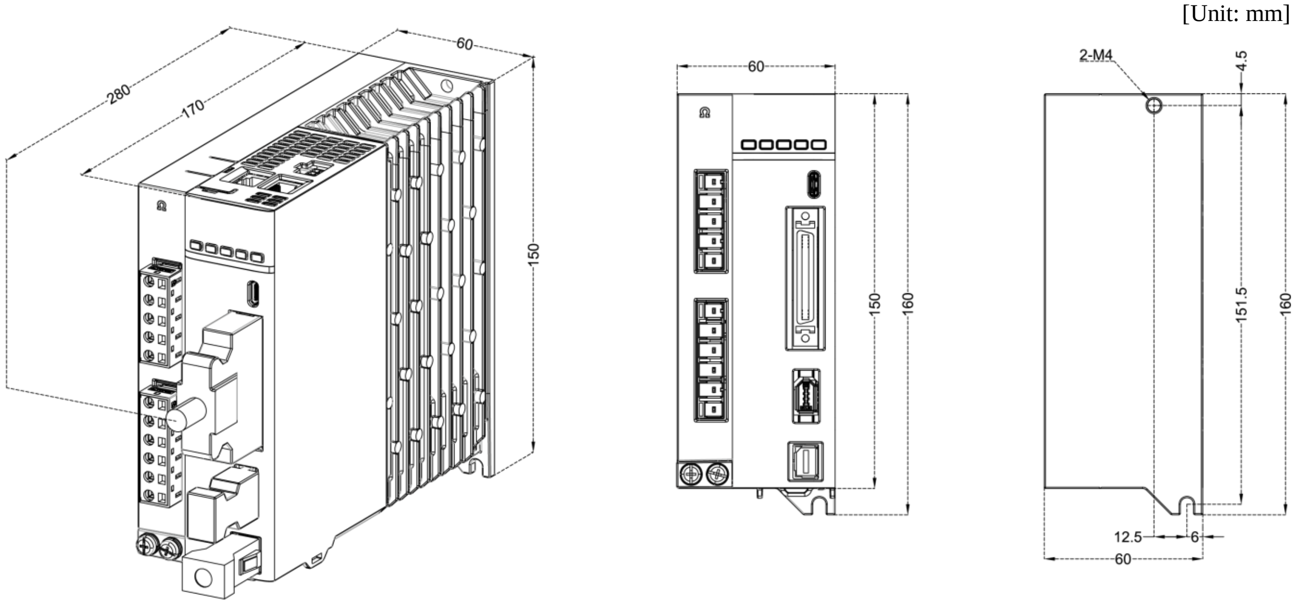


Figure 9.3.1-2 Outline dimension drawing of type B driver

[Unit: mm]

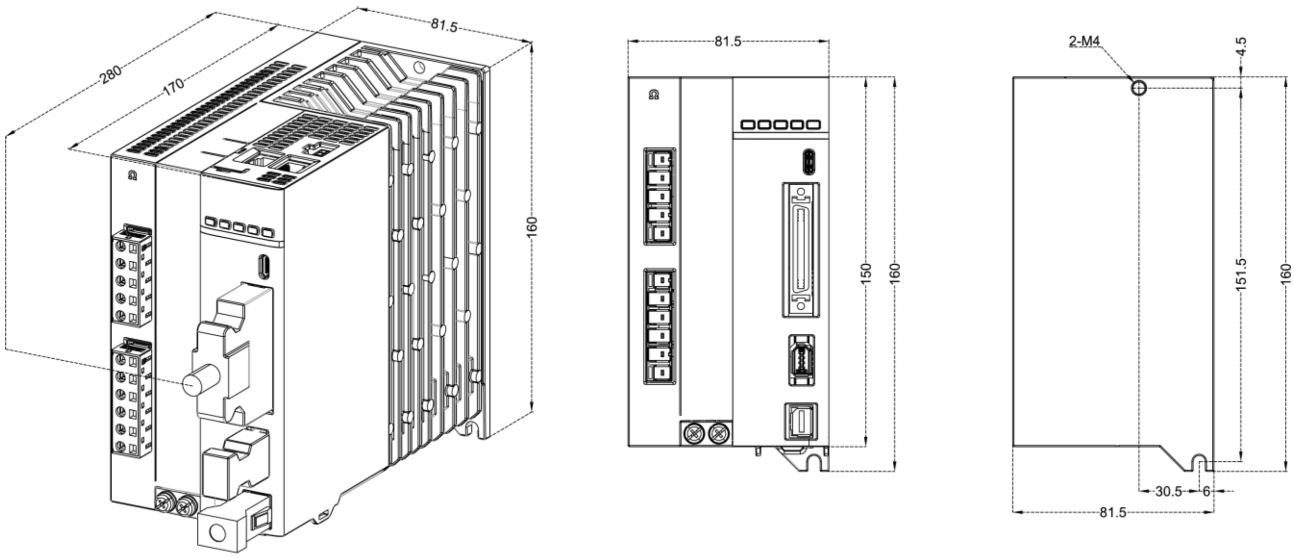


Figure 9.3.1-3 Outline dimension drawing of type C driver

[Unit: mm]

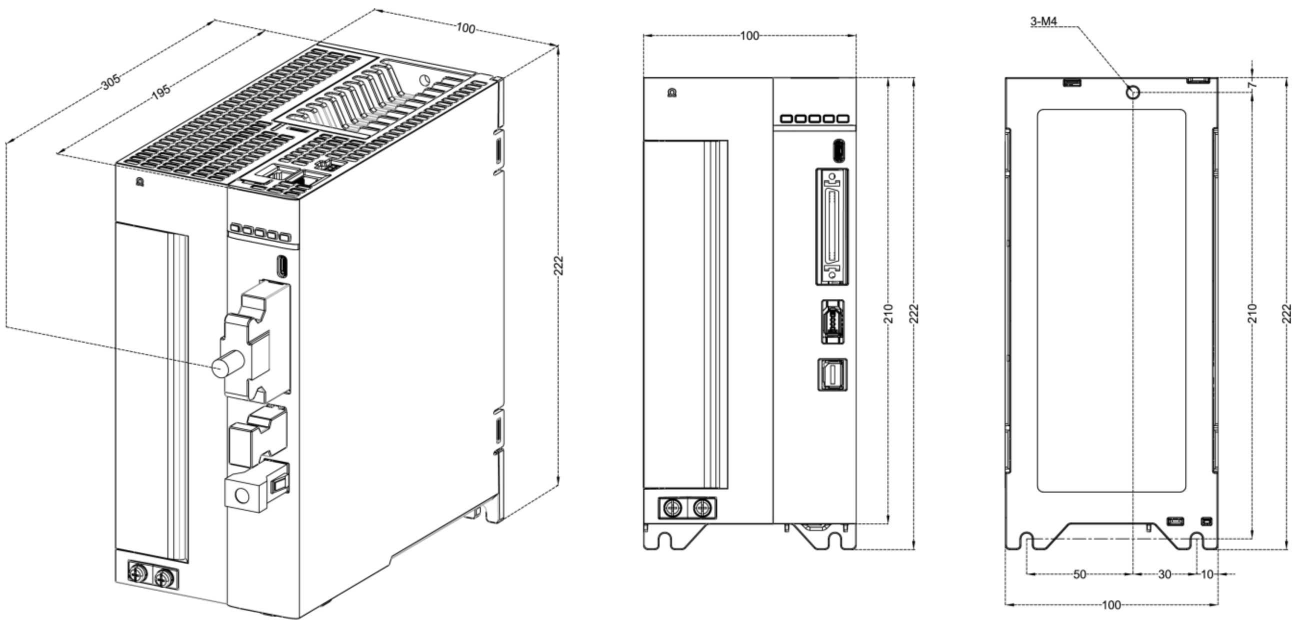
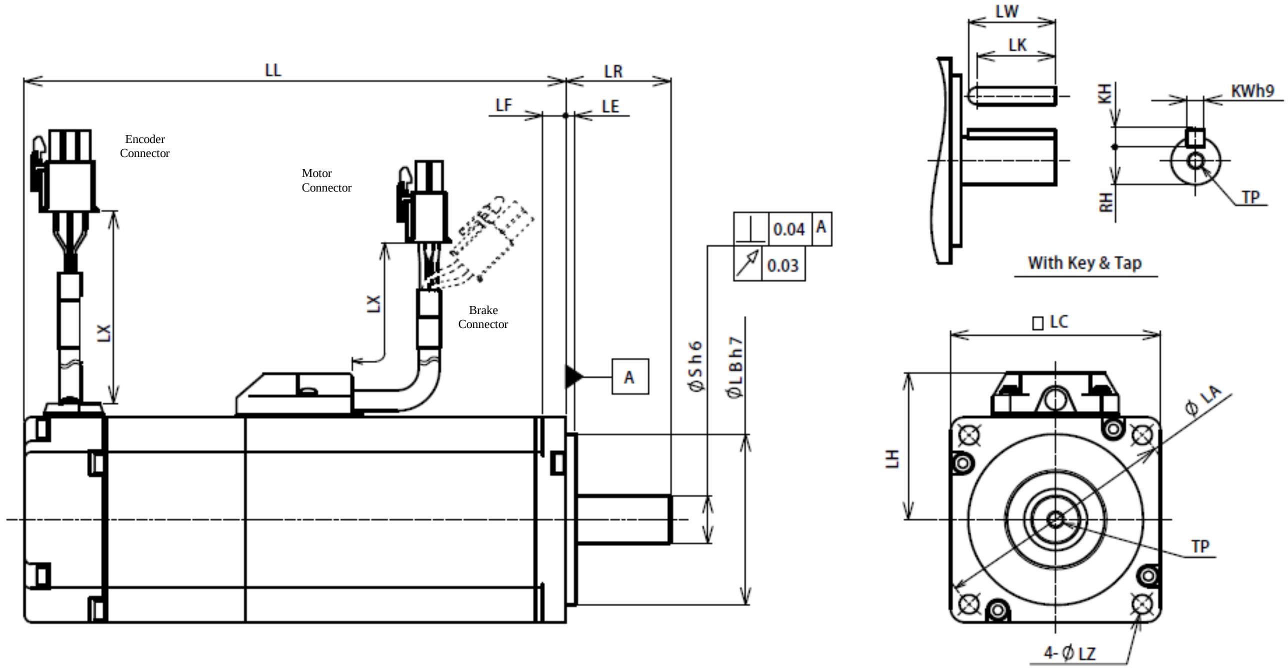


Figure 9.3.1-4 Outline dimension drawing of type D driver

9.3.2 Motor

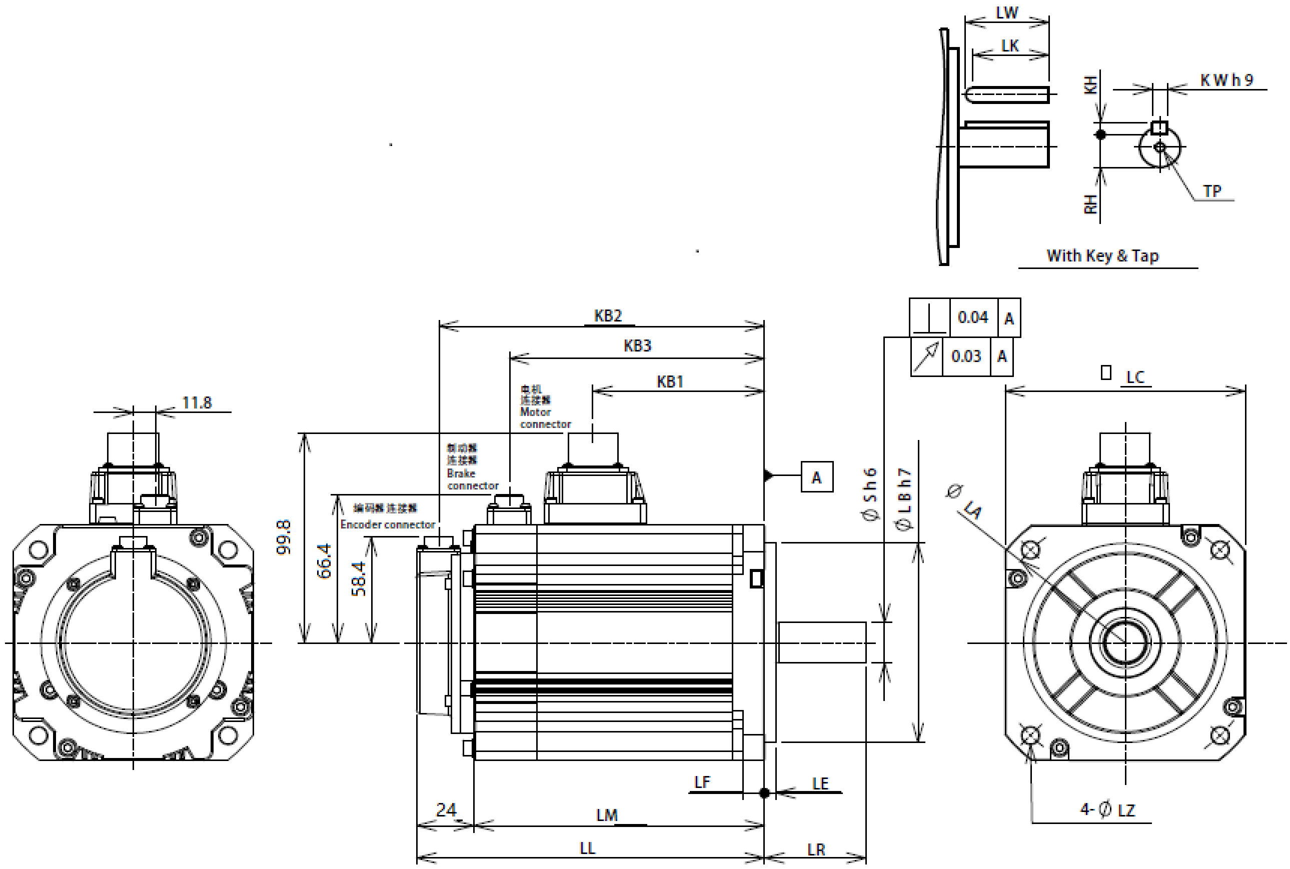
1. OM1 series motor

(1) OMS1 low inertia 200W~1.0kW (□80)



<table>
<tr><th colspan="3" rowspan="2">Motor model</th><th>200W low inertia</th><th>200W low inertia</th><th>400W low inertia</th><th>750W low inertia</th><th>1.0kW low inertia</th></tr>
<tr><th>OMS1201□2□□01</th><th>OMS1201</th><th>OMS1401</th><th>OMS1751</th><th>OMS1951</th></tr>
<tr><td colspan="3">LC</td><td colspan="3">□60</td><td colspan="2">□80</td></tr>
<tr><td rowspan="2">LL</td><td colspan="2">Without brake</td><td>76.5</td><td>76.5</td><td>93.5</td><td>107.3</td><td>127.3</td></tr>
<tr><td colspan="2">With brake</td><td>113</td><td>113</td><td>130</td><td>144.3</td><td>164.3</td></tr>
<tr><td colspan="3">LR</td><td>30</td><td colspan="2">30</td><td colspan="2">35</td></tr>
<tr><td colspan="3">S</td><td>11</td><td colspan="2">14</td><td colspan="2">19</td></tr>
<tr><td colspan="3">LA</td><td>70</td><td colspan="2">70</td><td colspan="2">90</td></tr>
<tr><td colspan="3">LB</td><td>50</td><td colspan="2">50</td><td colspan="2">70</td></tr>
<tr><td colspan="3">LE</td><td>3</td><td colspan="2">3</td><td colspan="2">3</td></tr>
<tr><td colspan="3">LF</td><td>6.5</td><td colspan="2">6.5</td><td colspan="2">8</td></tr>
<tr><td colspan="3">LH</td><td>43</td><td colspan="2">43</td><td colspan="2">53</td></tr>
<tr><td colspan="3">LX</td><td>210</td><td colspan="2">210</td><td colspan="2">210</td></tr>
<tr><td colspan="3">LZ</td><td>5.5</td><td colspan="2">5.5</td><td colspan="2">6.6</td></tr>
<tr><td rowspan="6">Shaft end</td><td rowspan="6">With key</td><td>LW</td><td>20</td><td colspan="2">25</td><td colspan="2">25</td></tr>
<tr><td>LK</td><td>18</td><td colspan="2">22.5</td><td colspan="2">22</td></tr>
<tr><td>KW</td><td>4</td><td colspan="2">5</td><td colspan="2">6</td></tr>
<tr><td>KH</td><td>4</td><td colspan="2">5</td><td colspan="2">6</td></tr>
<tr><td>RH</td><td>8.5</td><td colspan="2">11</td><td colspan="2">15.5</td></tr>
<tr><td>TP</td><td>M4 depth 8</td><td colspan="2">M5 depth 10</td><td colspan="2">M5 depth 10</td></tr>
</table>

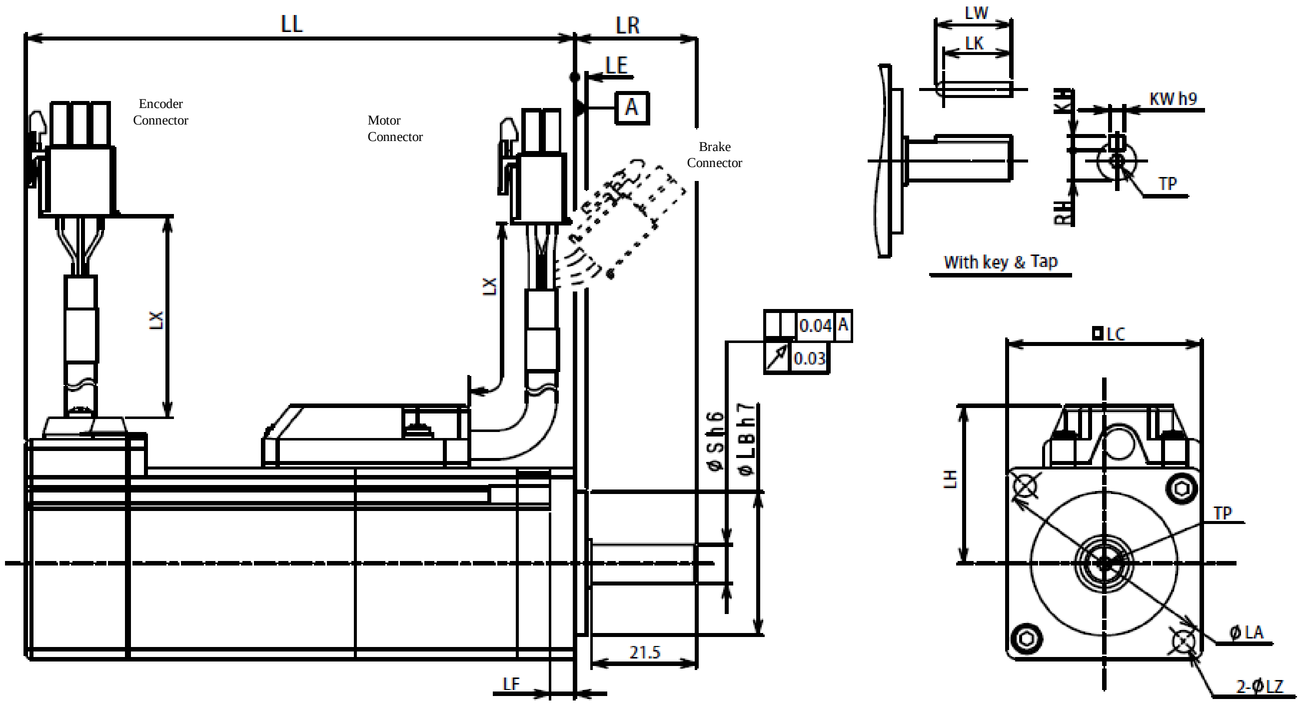
(2) OMS1 low inertia 1.0kW (□100)~2.0kW



Unit: mm

Motor model			1.0kW low inertia OMS1102	1.5kW low inertia OMS1152	2.0kW low inertia OMS1202
LC			□100		
LL	Without brake		132	151	170
	With brake		162	181	200
LM	Without brake		108	127	146
	With brake		138	157	176
LR			55		
S			19		
LA			115		
LB			95		
LE			3		
LF			10		
LZ			9		
KB1			78	97	116
KB2	Without brake		120	97	116
	With brake		150	139	158
KB3	Without brake		--	--	--
	With brake		119.3	138.3	157.3
Shaft end	With key	LW	45		
		LK	42		
		KW	6		
		KH	6		
		RH	15.5		
		TP	M5 depth 10		

(3) OMM1 medium inertia 50W, 100W

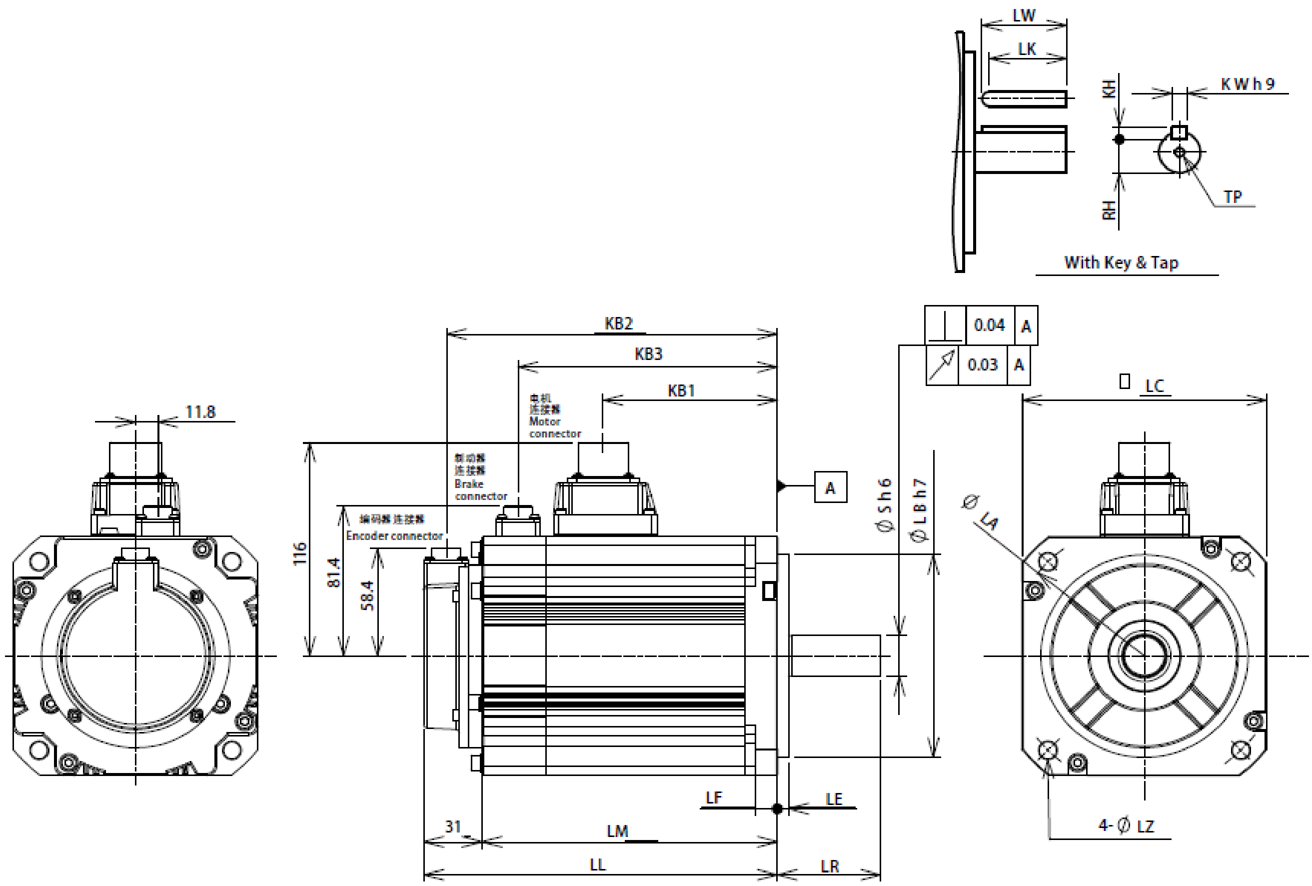


Unit: mm

Motor model			50W medium inertia		100W medium inertia	
			OMM1500□2S	OMM1500□2T	OMM1101□2S	OMM1101□2T
			OMM1500□2K	OMM1500□2L	OMM1101□2K	OMM1101□2L
LC			□40			
LL	Without brake		66.4	72	82.4	88
	With brake		106.8	112.4	122.8	128.4
LR			25			
S			8			
LA			46			
LB			30			
LE			2.5			
LF			5			
LH			33			
LX			210			
LZ			4.5			
Shaft end	With key	LW	15.5			
		LK	14			
		KW	3			
		KH	3			
		RH	6.2			
		TP	M3 depth 6			

Note: * * Oil seal protruding/flat

(4) OMM1 medium inertia 1.0kW~2.0kW

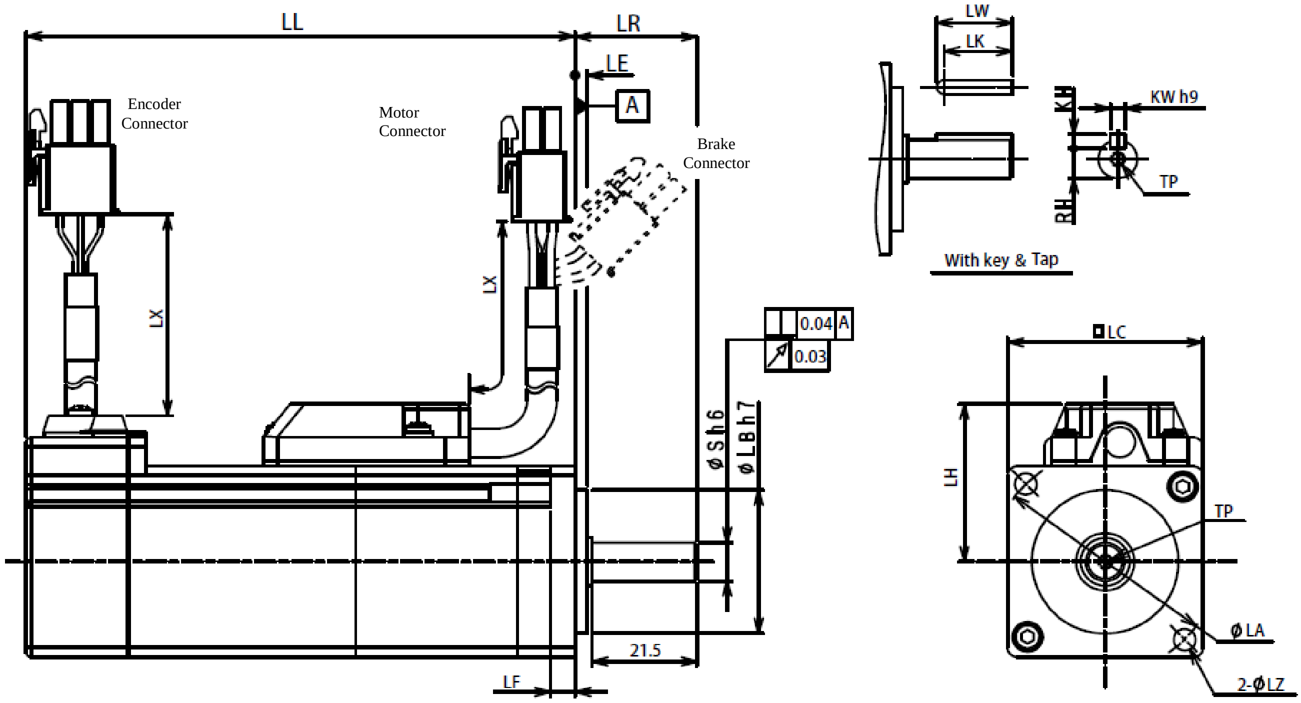


Unit: mm

Motor model			1.0kW medium inertia OMM1102	1.5kW medium inertia OMM1152	2.0kW medium inertia OMM1202
LC			□130		
LL	Without brake		128	145.5	163
LL	With brake		153	170.5	188
LM	Without brake		97	114.5	132
LM	With brake		122	139.5	157
LR			55	55	55
S			22	22	22
LA			145	145	145
LB			110	110	110
LE			6	6	6
LF			12	12	12
LZ			9	9	9
KB1			57.5	75	92.5
KB2	Without brake		116	133.5	151
KB2	With brake		141	158.5	176
KB3	Without brake		--	--	--
KB3	With brake		102.8	120.3	137.8
Shaft end	With key	LW	45		
Shaft end	With key	LK	41		
Shaft end	With key	KW	8		
Shaft end	With key	KH	7		

		RH	18
		TP	M6 depth 20

(5) OMD1 medium inertia 50W~400W



Unit: mm

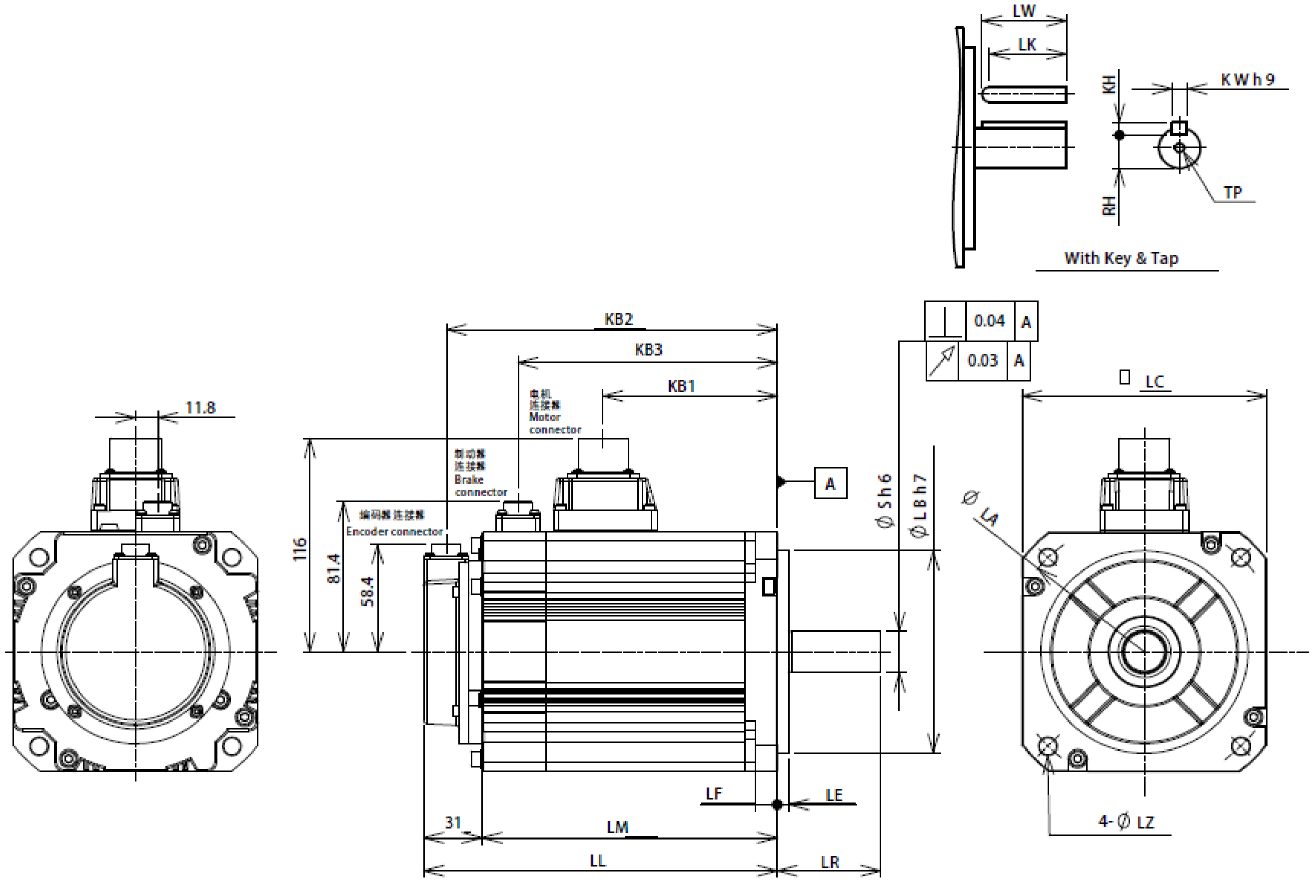
Motor model			50W medium inertia			100W medium inertia		
			OMD1500□2S	OMD1500□2T	OMD1500□2T□**	OMD1101□2S	OMD1101□2S	OMD1101□2S□**
			OMD1500□2K	OMD1500□2L	OMD1500□2L□**	OMD1101□2K	OMD1101□2K	OMD1101□2K□**
LC			□40					
LL	Without brake		57.1	64.7	59.2/61.7	70.7	78.3	72.8/75.3
	With brake		89.1	97.1	91.6/94.1	103.1	110.7	105.2/107.7
LR			25					
S			8					
LA			46					
LB			30					
LE			2.5					
LF			5					
LH			33					
LX			210					
LZ			4.5					
Shaft end	With key	LW	15.5					
		LK	14					
		KW	3					
		KH	3					
		RH	6.2					
		TP	M3 depth 6					

Note: * * Oil seal protruding/flat

Motor model			200W medium inertia OMD1201	400W medium inertia OMD1401
LC			□60	
LL	Without brake		78.5	98
	With brake		104.5	124.5
LR			30	
S			14	
LA			70	
LB			50	
LE			3	
LF			6.5	
LH			43	
LX			210	
LZ			5.5	
Shaft end	With key	LW	25	
		LK	22.5	
		KW	5	
		KH	5	
		RH	11	
		TP	M5 depth 10	

Note: The 200W/400W servo motor contains four mounting nuts.

(6) OMG1 high inertia 850W, 1.3kW

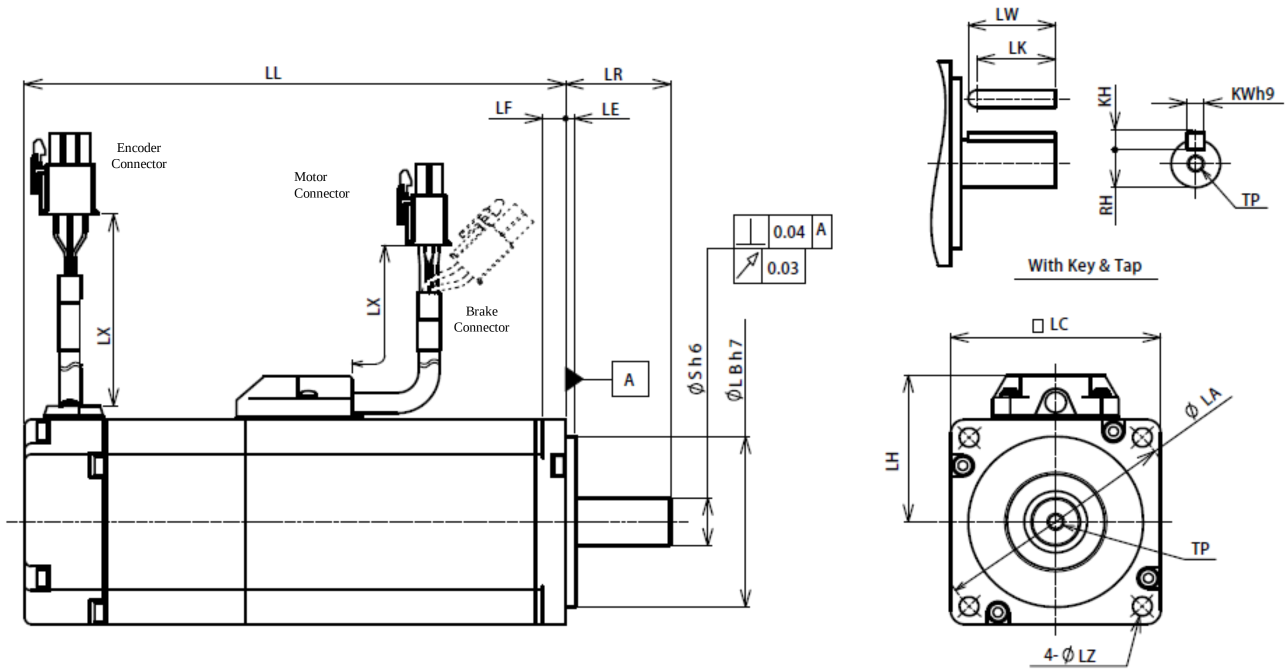


Unit: mm

Motor model		850W high inertia OMG1851	1.3kW high inertia OMG1132
LC		□130	
LL	Without brake	128	145.5
	With brake	162	179.5

LM	Without brake		97	114.5
	With brake		131	148.5
LR			58	58
S			19	22
LA			145	145
LB			110	110
LE			6	6
LF			12	12
LZ			9	9
KB1			70	87.5
KB2	Without brake		116	133.5
	With brake		150	167.5
KB3	Without brake		--	--
	With brake		109	126
Shaft end	With key	LW	28	28
		LK	25	25
		KW	5	6
		KH	5	6
		RH	16	19
		TP	M5 depth 12	M5 depth 12

(7) OMG1 high inertia 200W~750W

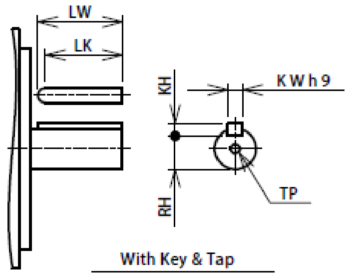


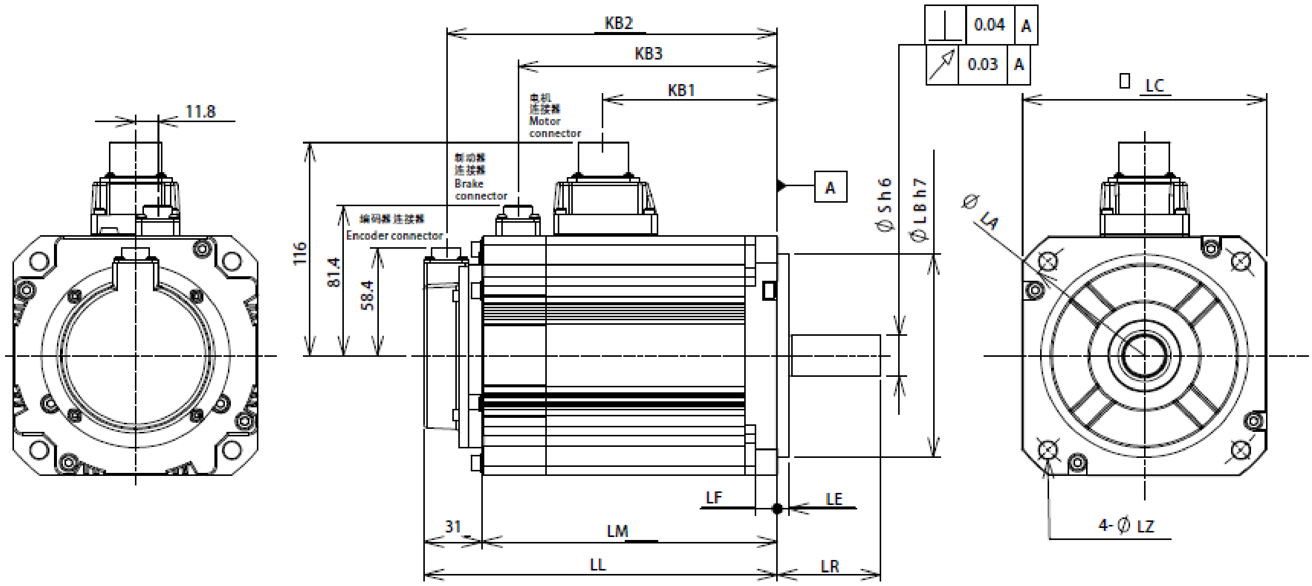
Unit: mm

Motor model			200W high inertia	200W high inertia	400W high inertia	750W high inertia
			OMH1201□2□□01	OMH1201	OMH1401	OMH1751
LC			□60			□80
LL	Without brake		93.5	93.5	110.5	122.3
	With brake		130	130	147	159.3
LR			30	30		35
S			11	14		19
LA			70	70		90
LB			50	50		70
LE			3	3		3
LF			6.5	6.5		8
LH			43	43		53
LX			210	210		210
LZ			5.5	5.5		6.6
Shaft	With	LW	20	25		25

end	key	LK	18	22.5	22
		KW	4	5	6
		KH	4	5	6
		RH	8.5	11	15.5
		TP	M4 depth 8	M5 depth 10	M5 depth 10

(8) OMH1 high inertia 1.0kW, 1.5kW





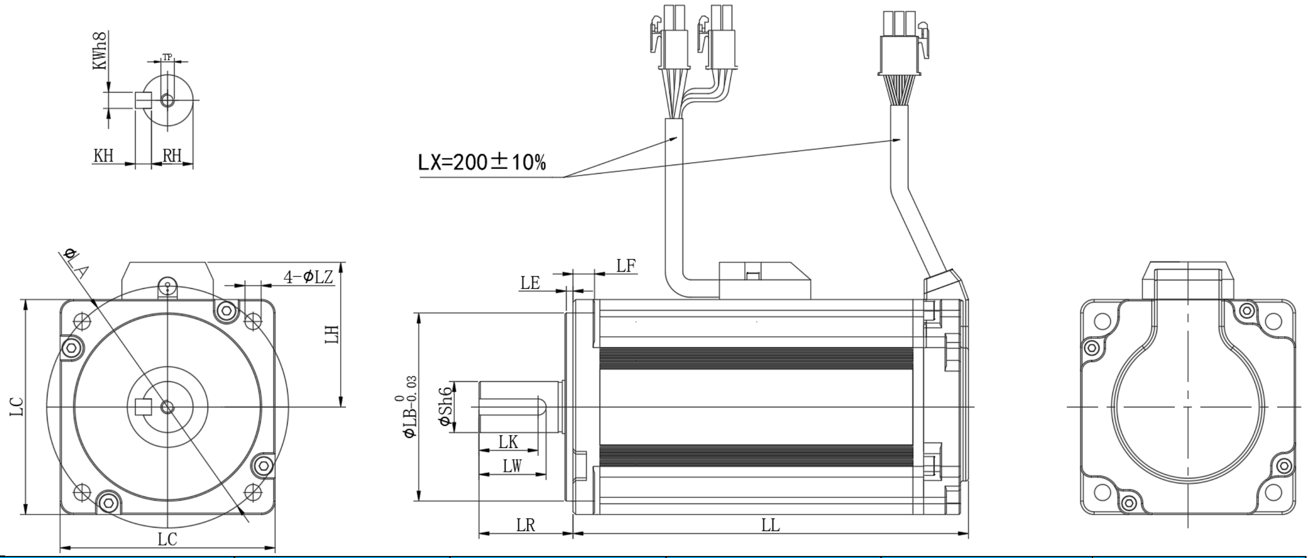
Unit: mm

Motor model		1.0kW high inertia OMH1102	1.5kW high inertia OMH1152
LC		□130	
LL	Without brake	163	180.5
	With brake	188	205.5
LM	Without brake	132	149.5
	With brake	157	174.5
LR		70	70
S		22	22
LA		145	145
LB		110	110
LE		6	6
LF		12	12
LZ		9	9
KB1		92.5	110
KB2	Without brake	151	168.5
	With brake	176	193.5
KB3	Without brake	--	--
	With brake	137.8	155.3
Shaft	With LW	45	

end	key	LK	41
		KW	8
		KH	7
		RH	18
		TP	M6 depth 20

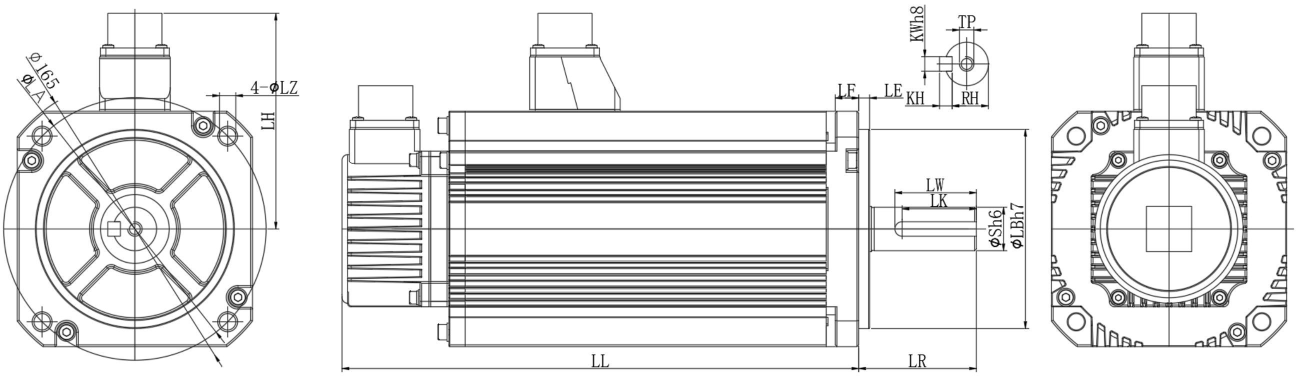
2. OM2 series motor

(1) OMS2 low inertia 100W~1.0kW (☐80)



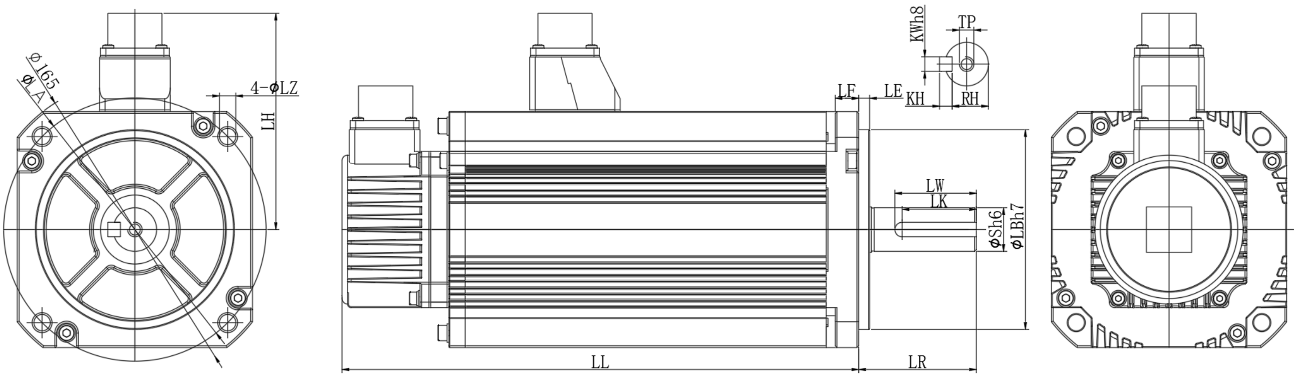
Motor model		100W low inertia	200W low inertia	400W low inertia	750W low inertia	1.0kW low inertia
		OMS2101	OMS2201	OMS2401	OMS2751	OMS2951
LC (Flange dimensions)		☐40	☐60		☐80	
LL	Without brake	98.1	91.5	111.5	120.5	145.5
	With brake	137.2	134.5	159.5	161.5	181.5
LR		25	30		35	
S		8	14		19	
LA		46	70		90	
LB		30	50		70	
LE		2.5	3		2.5	
LF		5	6.5		8	
LX		200	200		200	
LH		44.2	44		54	
LZ		4.5	5		6	
Shaft end With key	LK	12.5	22.5		22	
	LW	14	25		25	
	KW	3	5		6	
	KH	3	5		6	
	RH	6.2	11		15.5	
	TP	M3 depth 6	M5 depth 10			

(2) OMM2 medium inertia 1.0kW (☐130)~3.0kW



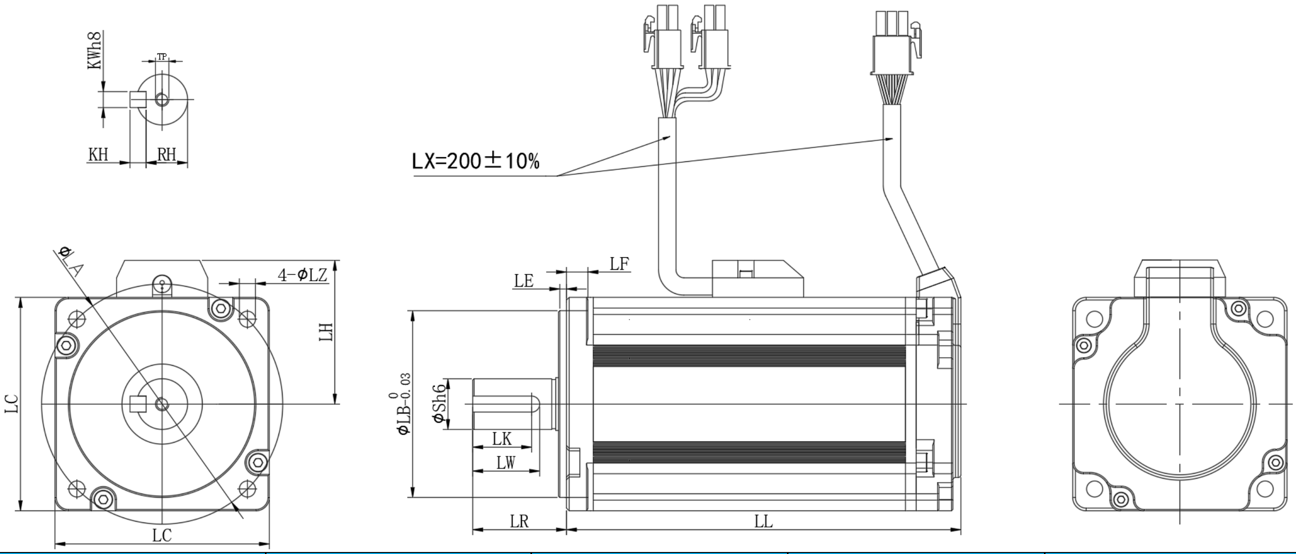
Motor model			1.0kW medium inertia	1.5kW medium inertia	2.0kW medium inertia	3.0kW medium inertia
			OMM2102	OMM2152	OMM2202	OMM2302
LC			□130			
LL	Without brake		163.5	181	198.5	251.5
	With brake		197.5	215	232.5	285.5
LR			55			65
S			22			24
LA			145			145
LB			110			110
LE			6			6
LF			13			13
LH			119			118
LZ			9			9
Shaft end	With key	LK	41			
		LW	45			
		KW	8			
		KH	7			
		RH	18			20
		TP	M8 depth 15			

(3) OMG2 high inertia 850W-1.8kW



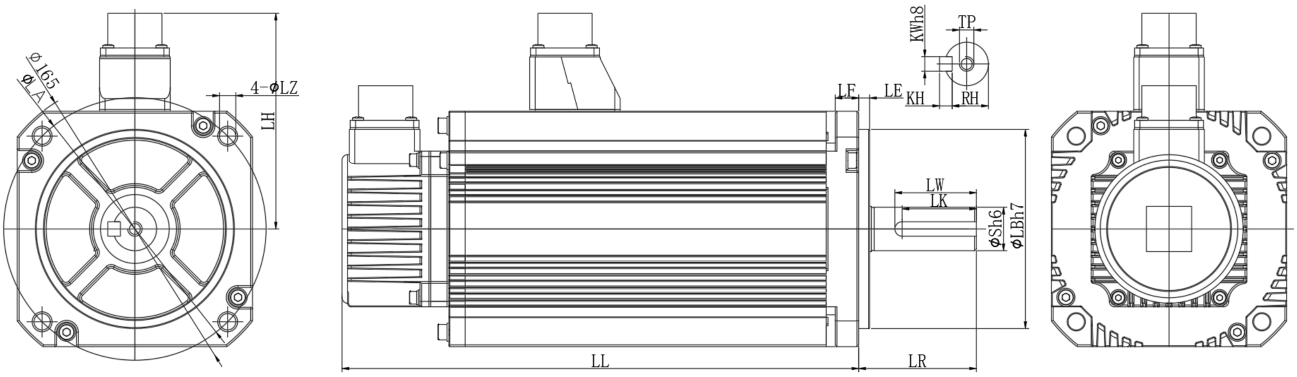
Motor model			850kW high inertia	1.3kW high inertia	1.8kW high inertia
			OMG2851	OMG2132	OMG2182
LC			□130		
LL	Without brake		181	198.5	216.5
	With brake		215	232.5	250
LR			55	55	
S			19	22	
LA			145	145	
LB			110	110	
LE			6	6	
LF			13	13	
LH			119	119	
LZ			9	9	
Shaft end	With key	LK	22.5	41	
		LW	25	45	
		KW	5	8	
		KH	5	7	
		RH	16	18	
		TP	M5 depth 10	M8 depth 15	

(4) OMH2 high inertia 200W~1.0kW (□80)



Motor model			200W high inertia	400W high inertia	750W high inertia	1.0kW high inertia
			OMH2201	OMH401	OMH2751	OMH2951
LC			□60		□80	
LL	Without brake		105.5	130.5	140.5	145.5
	With brake		143.5	168.5	181.5	186.5
LR			30		35	
S			14		19	
LA			70		90	
LB			50		70	
LE			3		2.5	
LF			6.5		8	
LX			200		200	
LH			44		54	
LZ			5		6	
Shaft end	With key	LK	22.5		22	
		LW	25		25	
		KW	5		6	
		KH	5		6	
		RH	11		15.5	
		TP	M5 depth 10		M5 depth 10	

(5) OMH2 high inertia 1.0kW (口130)~3.0kW



Motor model			1.0kW high inertia	1.5kW high inertia	2.0kW high inertia	3.0kW high inertia
			OMH2102	OMH152	OMH2202	OMH2302
LC			口130			
LL	Without brake		181	198.5	216.5	269
	With brake		215	232.5	250	303
LR			55			65
S			22			24
LA			145			145
LB			110			110
LE			6			6
LF			13			13
LH			119			118
LZ			9			9
Shaft end	With key	LK	41			41
		LW	45			45
		KW	8			8
		KH	7			7
		RH	18			20
		TP	M8 depth 15			M8 depth 15

9.4 Motor characteristics

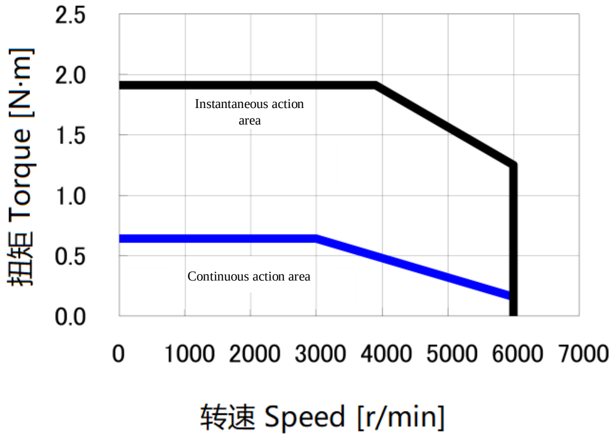
9.4.1 OM1 motor characteristics

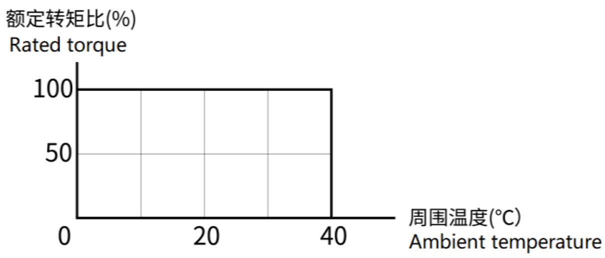
(1) OMS1 low inertia 200W~1.0kW (☐80)

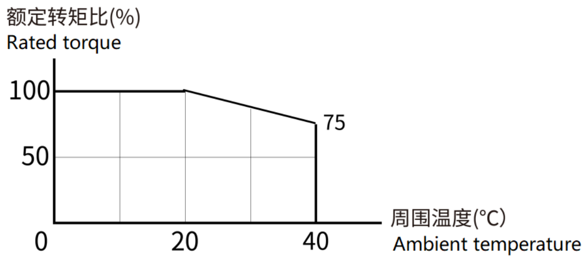
Items		Unit	Specification			
Motor model		-	OMS1201 Low inertia	OMS1401 Low inertia	OMS1751 Low inertia	OMS1951 Low inertia
Flange size		mm	☐60		☐80	
Driver supply voltage		V	AC220			
Rated output		W	200	400	750	1000
Rated torque		N·m	0.64	1.27	2.39	3.18
Max torque		N·m	1.91	3.82	7.1	9.55
Rated current		A	1.7	2.7	4.2	5.2
Highest current		A	5.2	8.5	12.2	15.2
Rated speed		r/min	3000			
Maximum speed		r/min	6000			
Torque constant		N・m/A	0.409	0.490	0.63	0.65
Opposite potential constant		mV/(r/min)	14.3	17.1	21.9	22.9
Rate of change of rated power	Without brake	kW/s	28.2	69.4	76.6	90.8
	With brake		23.5	61.8	60.7	78.6
Mechanical time constant	Without brake	ms	0.72	0.47	0.40	0.34
	With brake		0.87	0.53	0.50	0.4
Mechanical time constant		ms	2.53	2.92	4.6	3.95
Rotor inertia	Without brake	$\times 10^{-4}$kg・m^2	0.14	0.23	0.74	1.12
	With brake		0.17	0.26	0.94	1.29
Armature wire resistance		Ω	5.6	3.2	1.4	0.88
Armature wire inductance		mH	14.9	9.8	6.8	3.7
Number of pole pairs of motor		-	5 pole pairs			
Insulation grade		-	Class F			
Weight	Without brake	kg	0.8	1.1	2.2	2.8
	With brake		1.3	1.6	3.0	3.6
Heat dissipation conditions		-	350mm×350mm t=12 aluminum radiator			

S-T characteristics/continuous torque-ambient temperature

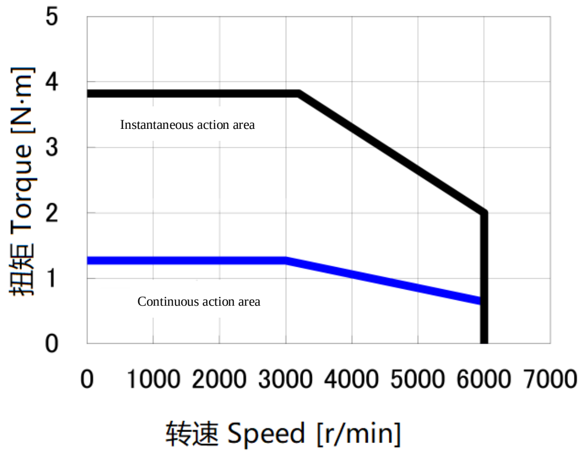
OMS1201	
Without oil seal	With oil seal

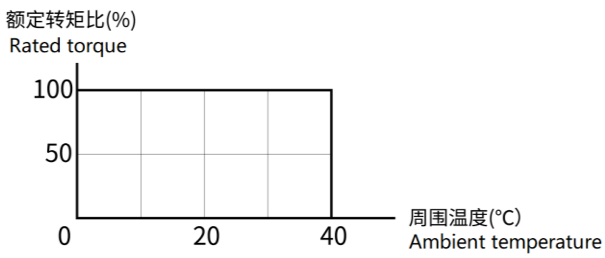


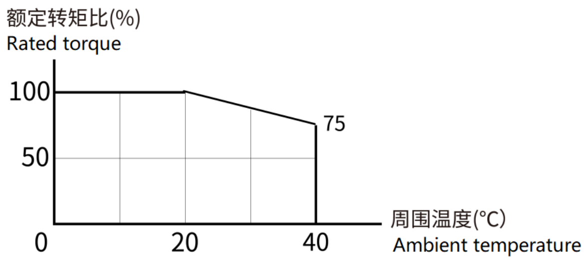




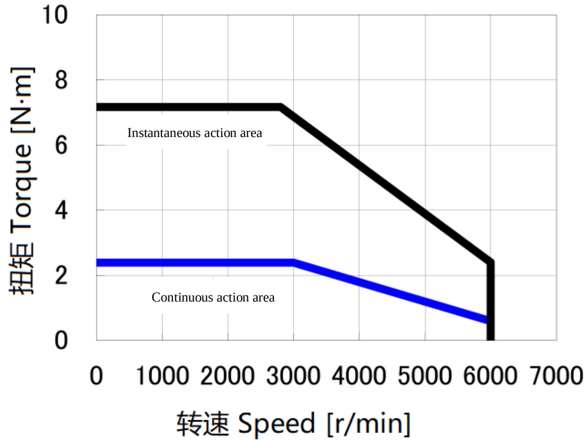
OMS1401	
Without oil seal	With oil seal

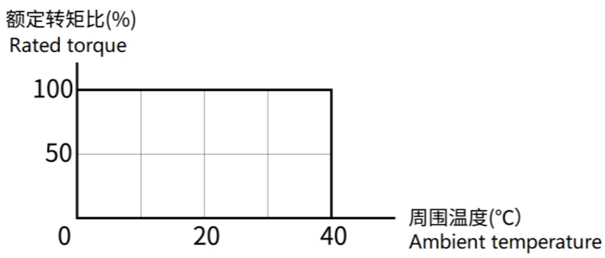


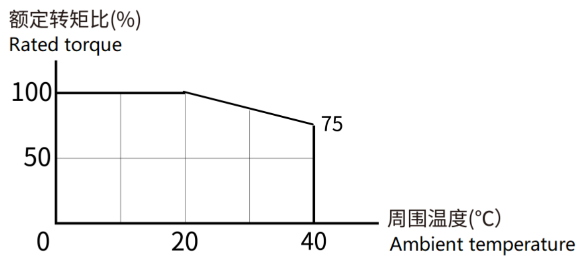




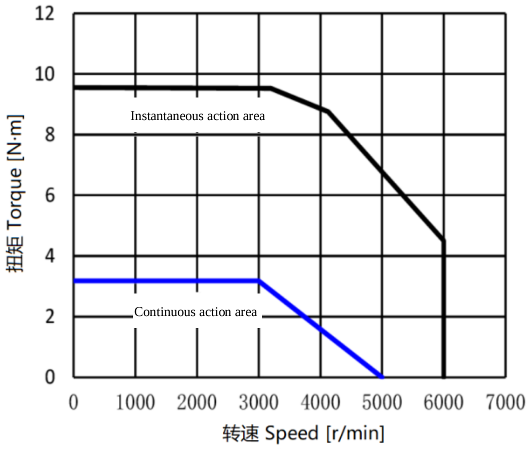
OMS1751	
Without oil seal	With oil seal

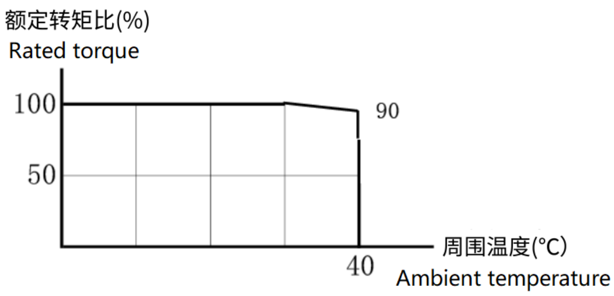


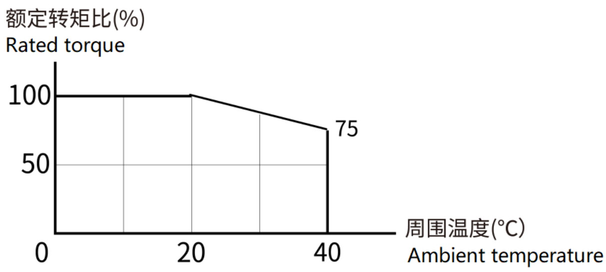




OMS1951	
Without oil seal	With oil seal







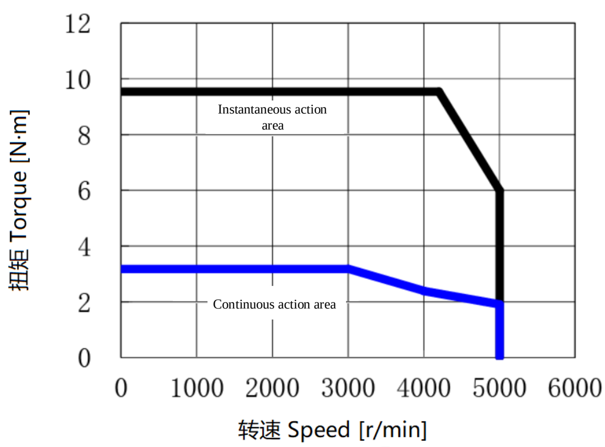
2. OMS1 low inertia 1.0kW (□100)~2.0kW

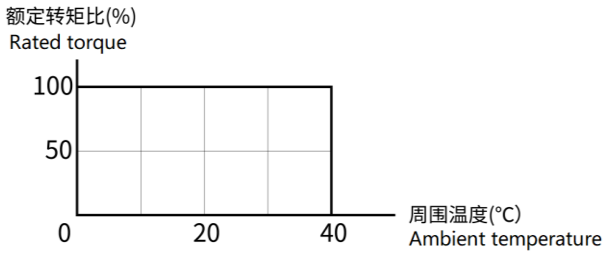
Items	Unit	Specification		
Motor model	-	OMS1102	OMS1152	OMS1202

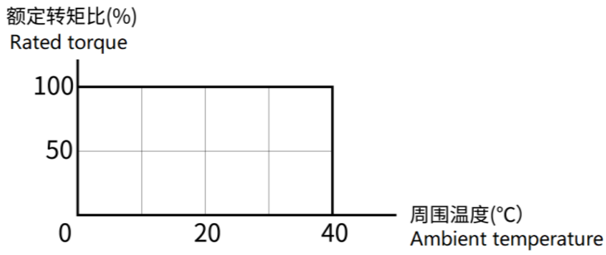
			Low inertia	Low inertia	Low inertia
Flange size		mm	□100		
Driver supply voltage		V	AC220		
Rated output		kW	1.0	1.5	2.0
Rated torque		N·m	3.18	4.77	6.37
Max torque		N·m	9.55	14.3	19.1
Rated current		A	6.8	7.6	10.6
Highest current		A	19.9	24.9	33.9
Rated speed		r/min	3000		
Maximum speed		r/min	5000		
Torque constant		N・m/A	0.52	0.64	0.62
Opposite potential constant		mV/(r/min)	18.15	22.27	21.68
Rated power	Without brake	kW/s	52.1	81.1	110.0
	With brake		43.0	70.1	99.0
Mechanical time constant	Without brake	ms	0.59	0.5	0.5
	With brake		0.72	0.58	0.56
Mechanical time constant		ms	5.19	5.95	5.44
Rotor inertia	Without brake	×10-4kg・m2	1.94	2.81	3.68
	With brake		2.35	3.25	4.09
Armature wire resistance		Ω	0.55	0.48	0.35
Armature wire inductance		mH	3.0	3.0	2.0
Number of pole pairs of motor		-	5 pole pairs		
Insulation grade		-	Class F		
Weight	Without brake	kg	3.9	4.9	6.0
	With brake		5.2	6.2	7.3
Cooling conditions		-	470mm×470mmt=20 aluminum radiator		

Continuous torque-ambient temperature/S-T characteristics

OMS1102	
Without oil seal	With oil seal

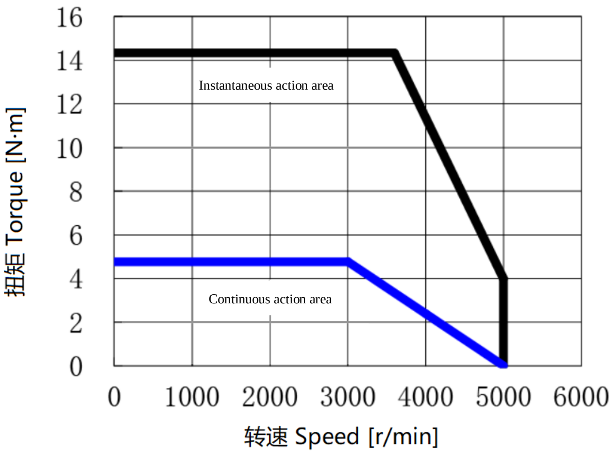


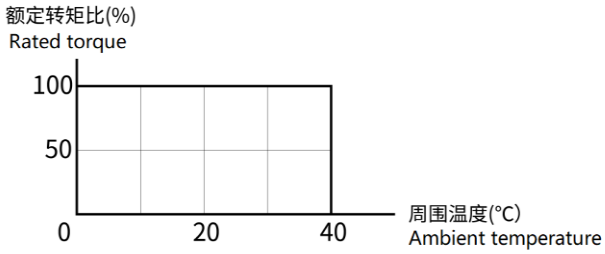


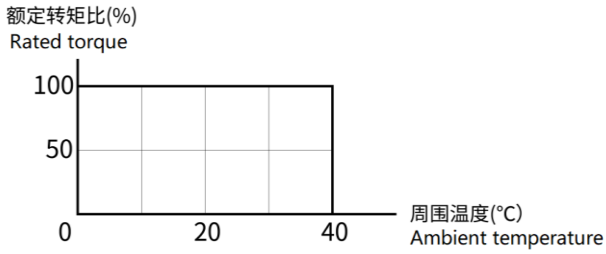


OMS1152

Without oil seal	With oil seal

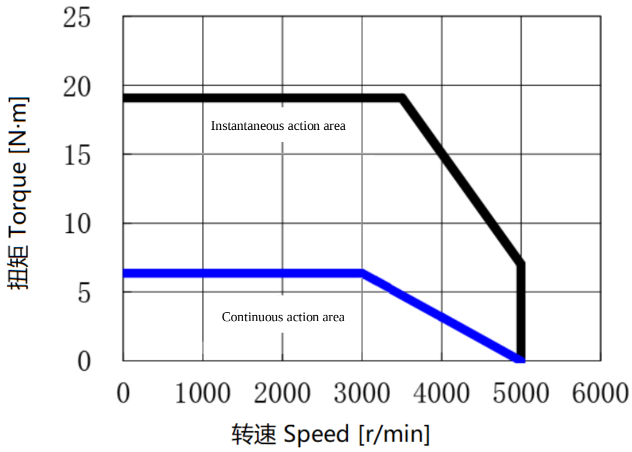


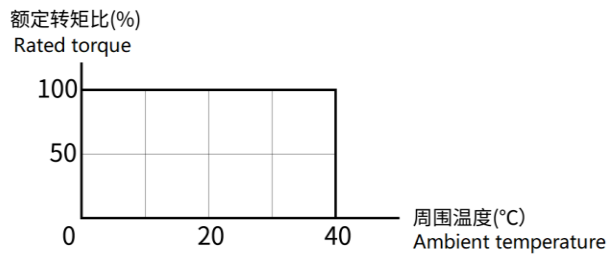


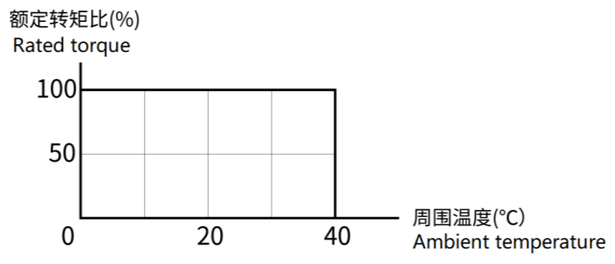


OMS1202

Without oil seal	With oil seal





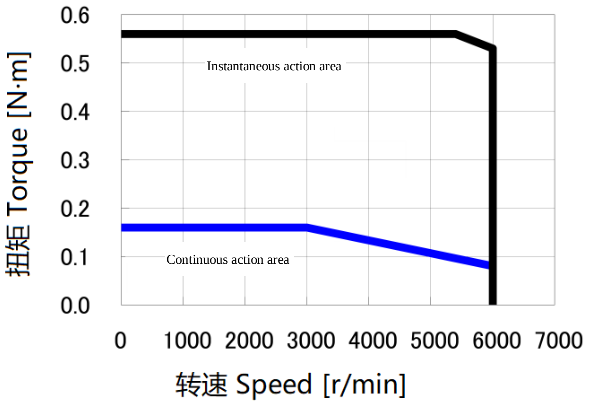


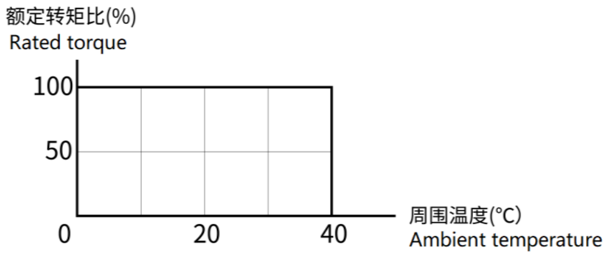
3. OMM1 medium inertia 50W, 100W

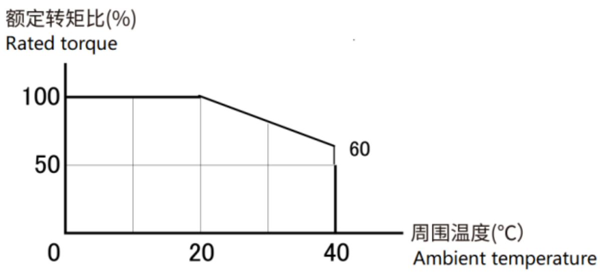
Items		Unit	Specification	
Motor		-	OMM1500 Medium inertia	OMM1101 Medium inertia
Flange size		mm	□40	
Driver supply voltage		V	AC220	
Rated output		W	50	100
Rated torque		N·m	0.16	0.32
Max torque		N·m	0.56	1.12
Rated current		A	0.68	0.97
Highest current		A	2.4	3.3
Rated speed		r/min	3000	
Maximum speed		r/min	6000	
Torque constant		N・m/A	0.25	0.35
Opposite potential constant		mV/(r/min)	8.8	12.3
Rate of change of rated power	Without brake	kW/s	6.5	16.5
	With brake		5.4	14.6
Mechanical time constant	Without brake	ms	1.92	1.17
	With brake		2.31	1.32
Mechanical time constant		ms	0.74	0.89
Rotor inertia	Without brake	$\times 10^{-4}$kg・m^2	0.039	0.061
	With brake		0.047	0.069
Armature wire resistance		Ω	21.1	15.6
Armature wire inductance		mH	16.5	14.6
Number of pole pairs of motor		-	5 pole pairs	
Insulation grade		-	Class F	
Weight	Without brake	kg	0.4	0.5
	With brake		0.6	0.8
Heat dissipation conditions		-	250mm×250mmt=12 aluminum radiator	

S-T characteristics/continuous torque-ambient temperature

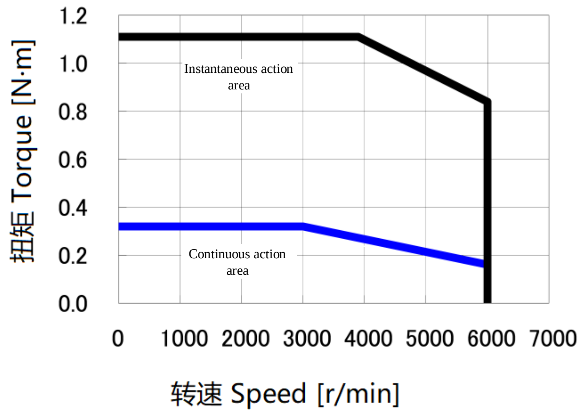
OMM1500	
Without oil seal	With oil seal

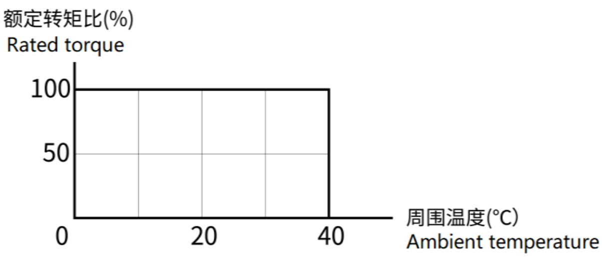


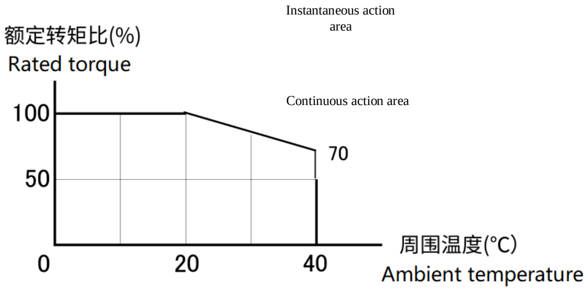




OMM1101	
Without oil seal	With oil seal







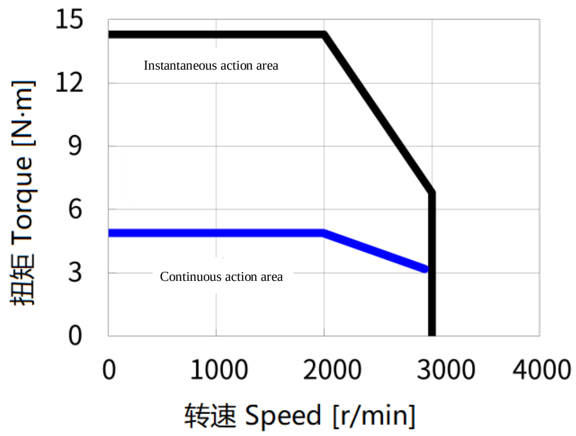
4. OMM1 medium inertia 1.0kW~2.0kW

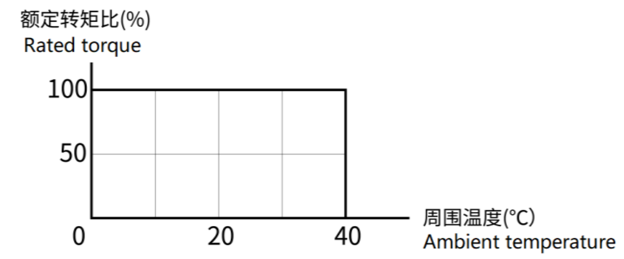
Items	Unit	Specification		
Motor model	-	OMM1102 Medium inertia	OMM1152 Medium inertia	OMM1202 Medium inertia
Flange size	mm	☐130		
Driver supply voltage	V	AC220		

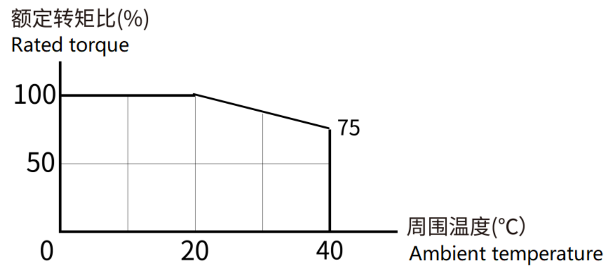
Rated output		kW	1.0	1.5	2.0
Rated torque		N·m	4.77	7.16	9.55
Max torque		N·m	14.3	21.5	28.6
Rated current		A	5.6	9.0	11.9
Highest current		A	16.8	27	35.7
Rated speed		r/min	2000		
Maximum speed		r/min	3000		
Torque constant		N・m/A	0.88	0.81	0.85
Opposite potential constant		mV/(r/min)	30.9	28.4	29.6
Rated power	Without brake	kW/s	50.0	76.9	104.9
	With brake		36.5	61.4	87.9
Mechanical time constant	Without brake	ms	0.76	0.60	0.58
	With brake		1.05	0.75	0.69
Mechanical time constant		ms	10.1	12.2	12.2
Rotor inertia	Without brake	×10-4kg・m2	4.56	6.67	8.70
	With brake		6.24	8.35	10.38
Armature wire resistance		Ω	0.88	0.40	0.32
Armature wire inductance		mH	10.0	5.0	4.0
Number of pole pairs of motor		-	5 pole pairs		
Insulation grade		-	Class F		
Weight	Without brake	kg	5.6	7.0	8.4
	With brake		7.0	8.4	9.8
Cooling conditions		TUV certification conditions	Approximately 260 mm×260 mm L type radiator (aluminum)		
		UL certification conditions	400mmt=20 aluminum radiator		

S-T characteristics/continuous torque-ambient temperature

OMM1102	
Without oil seal	With oil seal

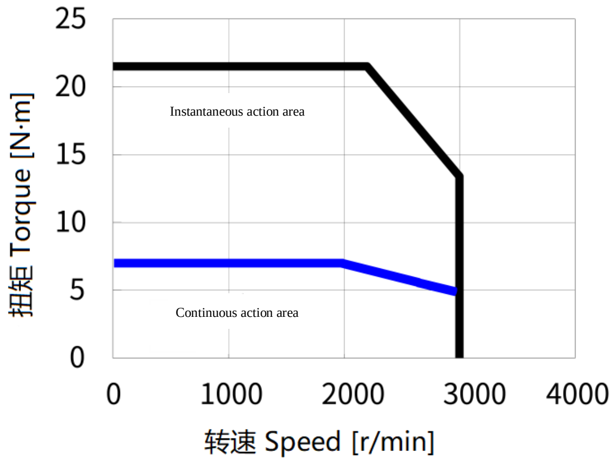


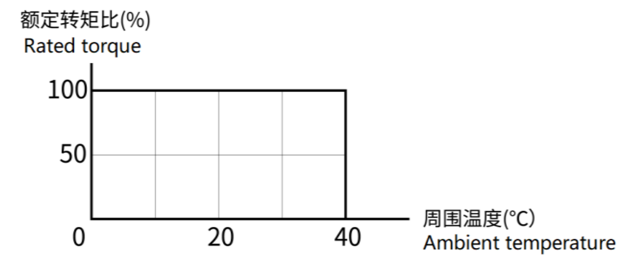


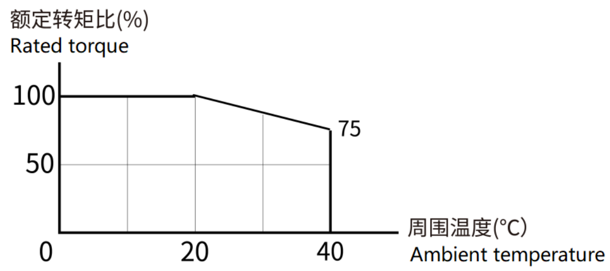


OMM1152

Without oil seal	With oil seal

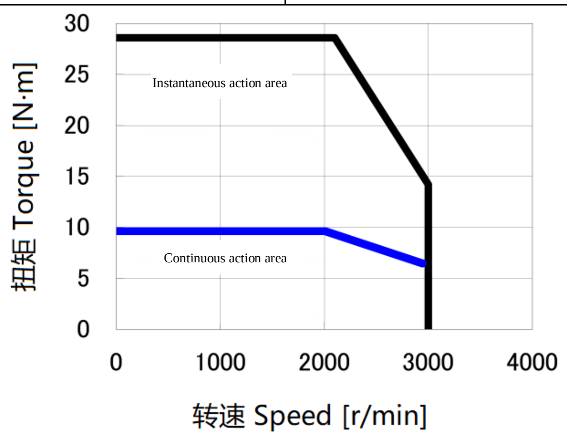


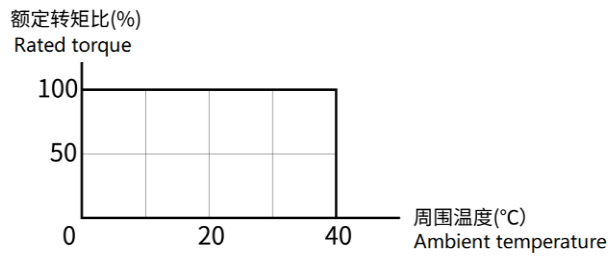


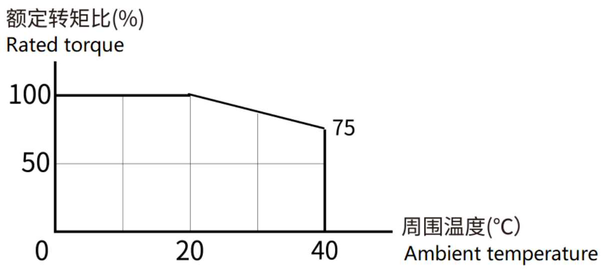


OMM1202

Without oil seal	With oil seal





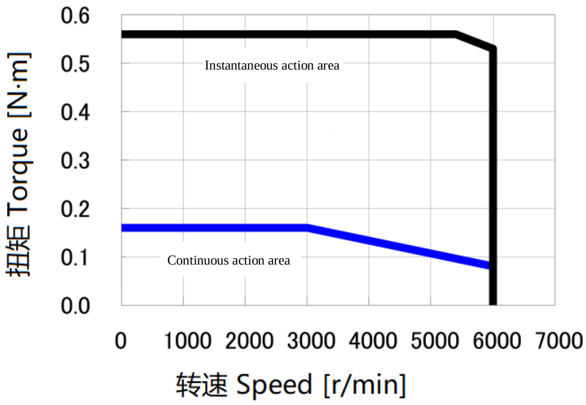


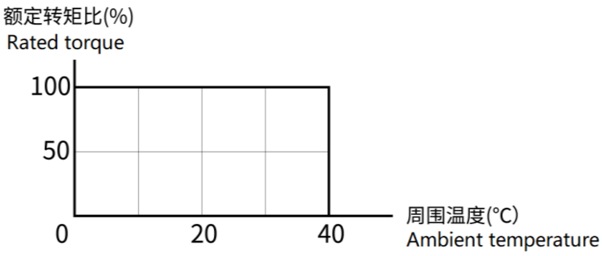
5. OMD1 medium inertia 50W~400W

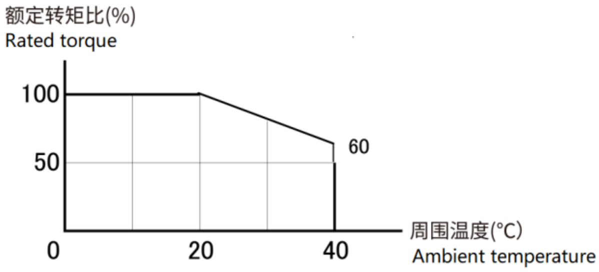
Items		Unit	Specification			
Motor		-	OMD1500 Medium inertia	OMD1101 Medium inertia	OMD1201 Medium inertia	OMD1401 Medium inertia
Flange size		mm	☐40		☐60	
Driver supply voltage		V	AC220			
Rated output		W	50	100	200	400
Rated torque		N·m	0.16	0.32	0.64	1.27
Max torque		N·m	0.56	1.12	1.91	3.82
Rated current		A	0.71	0.99	1.7	2.7
Highest current		A	2.4	3.4	5.2	8.5
Rated speed		r/min	3000			
Maximum speed		r/min	6000			
Torque constant		N · m/A	0.25	0.37	0.409	0.490
Opposite potential constant		mV/(r/min)	8.7	12.7	14.3	17.1
Rate of change of rated power	Without brake	kW/s	6.6	15.8	15.9	33.7
	With brake		5.4	14.1	14.6	32.1
Mechanical time constant	Without brake	ms	2.08	1.23	1.28	0.96
	With brake		2.51	1.38	1.4	1.01
Mechanical time constant		ms	0.65	0.78	2.53	2.92
Rotor inertia	Without brake	$\times 10^{-4}$kg · m^2	0.039	0.064	0.255	0.481
	With brake		0.047	0.072	0.279	0.504
Armature wire resistance		Ω	22.4	17.0	5.6	3.2
Armature wire inductance		mH	15.3	13.9	14.9	9.8
Number of pole pairs of motor		-	5 pole pairs			
Insulation grade		-	Class F			
Weight	Without brake	kg	0.4	0.5	0.8	1.1
	With brake		0.6	0.7	1.3	1.6
Heat dissipation conditions		-	250mm×250mmt=12 aluminum radiator		350mm×350mm t=12 aluminum radiator	

S-T characteristics/continuous torque-ambient temperature

OMD1500	
Without oil seal	With oil seal

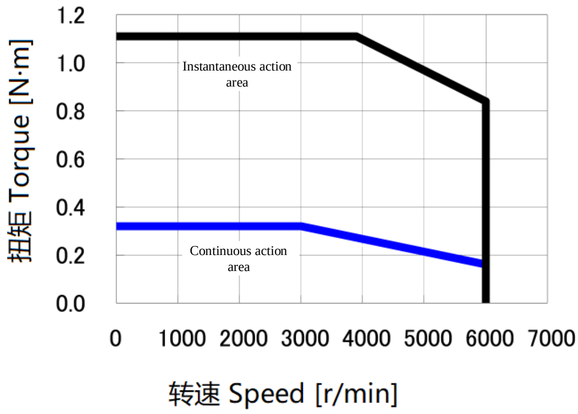


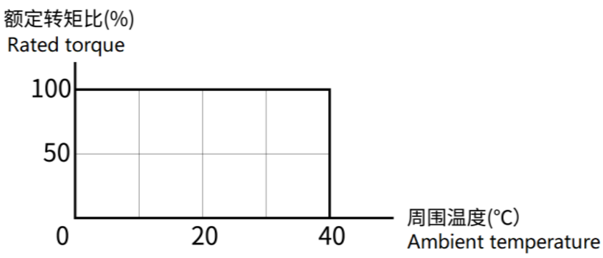


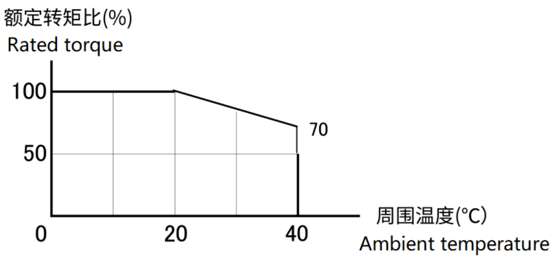


OMD1101

Without oil seal	With oil seal

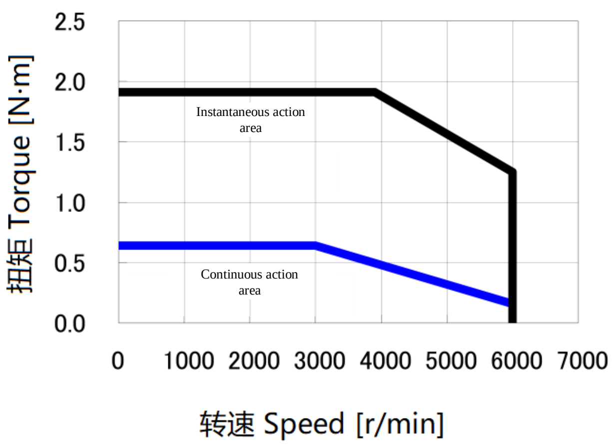


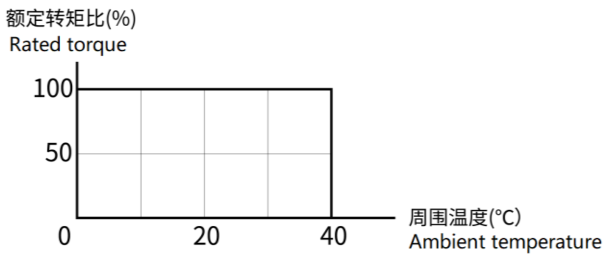


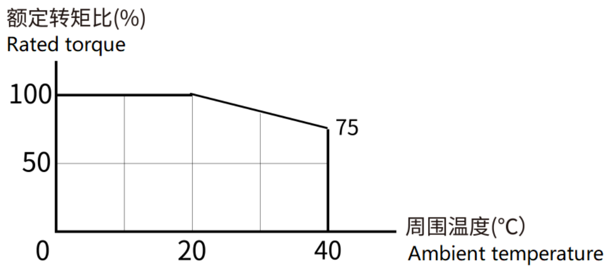


OMD1201

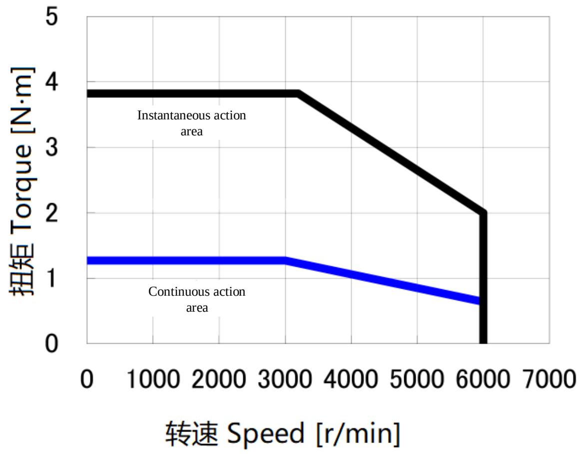
Without oil seal	With oil seal

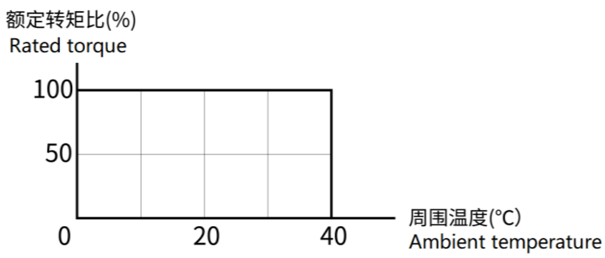


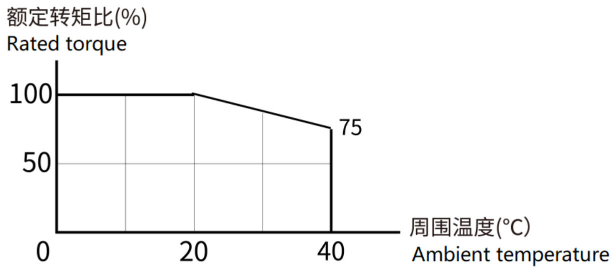




OMD1401	
Without oil seal	With oil seal







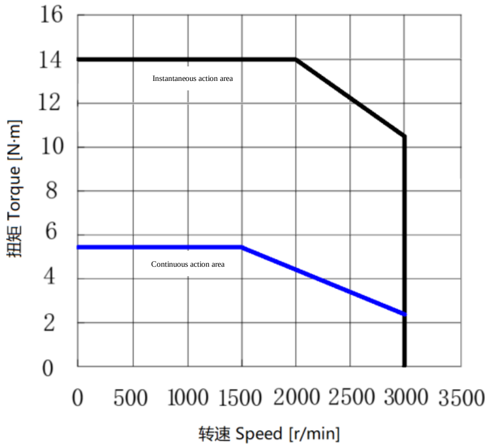
6. OMG1 high inertia 850W, 1.3kW

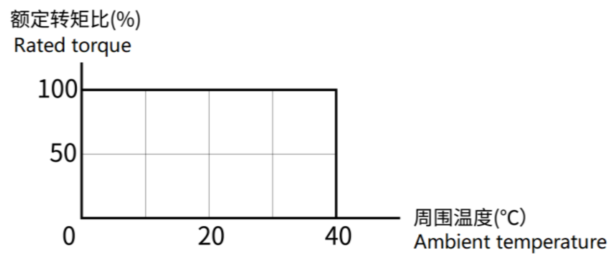
Items	Unit		
Motor model	-	OMG1851	OMG1132

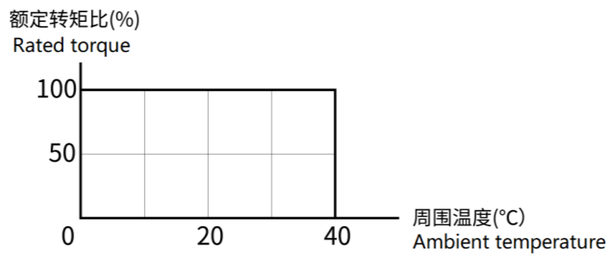
			High inertia	High inertia
Flange size		mm	□130	
Driver supply voltage		V	AC220	
Rated output		W	850	1300
Rated torque		N·m	5.39	8.34
Max torque		N·m	14.2	23.3
Rated current (locked-rotor current)		A	6.9	10.7
Highest current		A	17	28
Rated speed		r/min	1500	
Maximum speed		r/min	3000	
Torque constant		N・m/A	0.828	0.853
Opposite potential constant		mV/(r/min)	28.9	29.8
Rate of change of rated power	Without brake	kW/s	21.1	34.6
	With brake		18.3	31.3
Mechanical time constant	Without brake	ms	2.7	2.1
	With brake		3.1	2.3
Mechanical time constant		ms	8.45	8.42
Rotor inertia	Without brake	$\times10^{-4}$kg・m^2	13.9	19.8
	With brake		16.0	21.9
Armature wire resistance		Ω	0.89	0.52
Armature wire inductance		mH	7.9	4.6
Number of pole pairs of motor		-	5 pole pairs	
Insulation grade		-	Class F	
Weight	Without brake	kg	--	--
	With brake		--	--
Heat dissipation conditions		-	400mm×400mm t=20 aluminum radiator	

S-T characteristics/continuous torque-ambient temperature

OMG1851	
Without oil seal	With oil seal

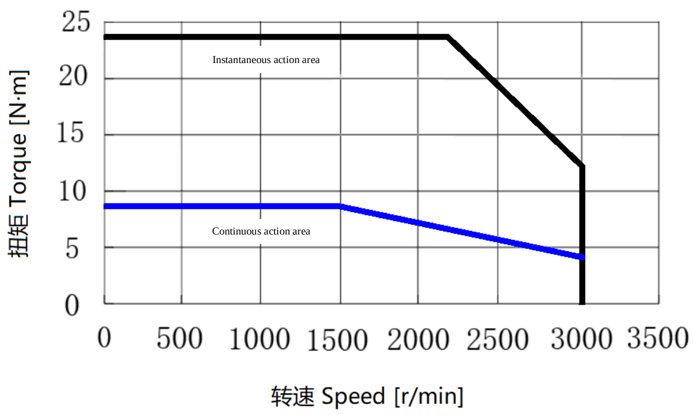


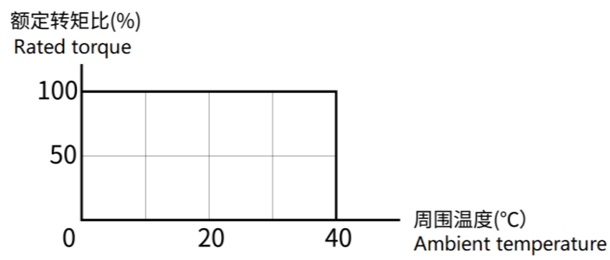


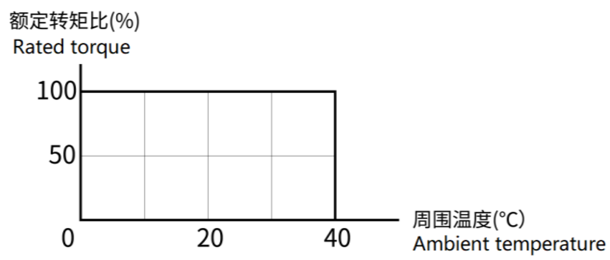


OMG1132

Without oil seal	With oil seal







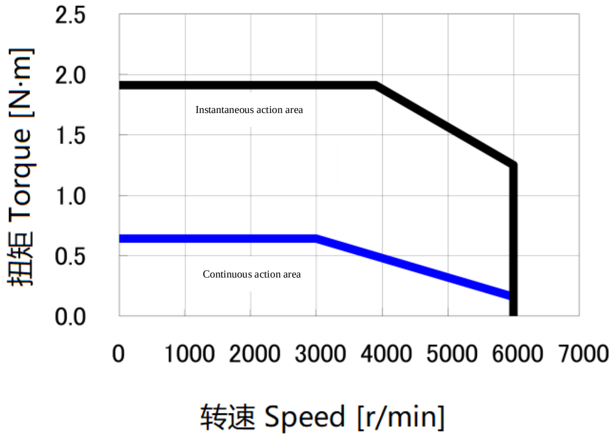
7. OMH1 high inertia 200W~750W

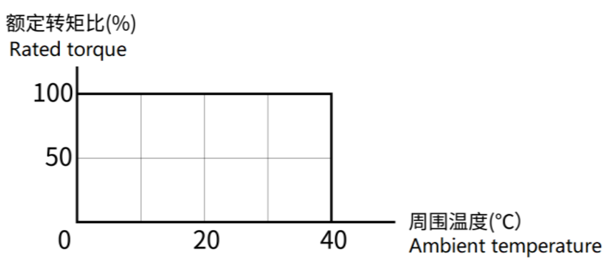
Items		Unit	Specification		
Motor model		-	OMH1201 High inertia	OMH1401 High inertia	OMH1751 High inertia
Flange size		mm	□60		□80
Driver supply voltage		V	AC220		
Rated output		W	200	400	750
Rated torque		N·m	0.64	1.27	2.39
Max torque		N·m	1.91	3.82	7.1
Rated current		A	1.7	2.7	4.2
Highest current		A	5.2	8.5	12.2
Rated speed		r/min	3000		
Maximum speed		r/min	6000		
Torque constant		N · m/A	0.409	0.490	0.63
Opposite potential constant		mV/(r/min)	14.3	17.1	21.9
Rate of change of rated	Without brake	kW/s	9.1	23.0	35.4
	With brake		8.6	22.1	31.6

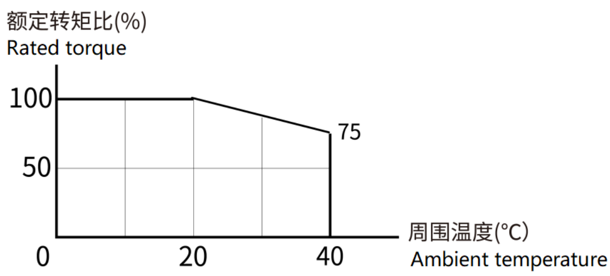
power					
Mechanical time constant	Without brake	ms	2.23	1.42	1.17
	With brake		2.38	1.47	1.32
Mechanical time constant		ms	2.53	2.92	4.6
Rotor inertia	Without brake	$\times 10^{-4}$kg・m^2	0.44	0.71	1.61
	With brake		0.47	0.73	1.81
Armature wire resistance		Ω	5.6	3.2	1.4
Armature wire inductance		mH	14.9	9.8	6.8
Number of pole pairs of motor		-	5 pole pairs		
Insulation grade		-	Class F		
Weight	Without brake	kg	1.0	1.3	2.5
	With brake		1.5	1.8	3.3
Heat dissipation conditions		-	350mm×350mm t=12 aluminum radiator		

S-T characteristics/continuous torque-ambient temperature

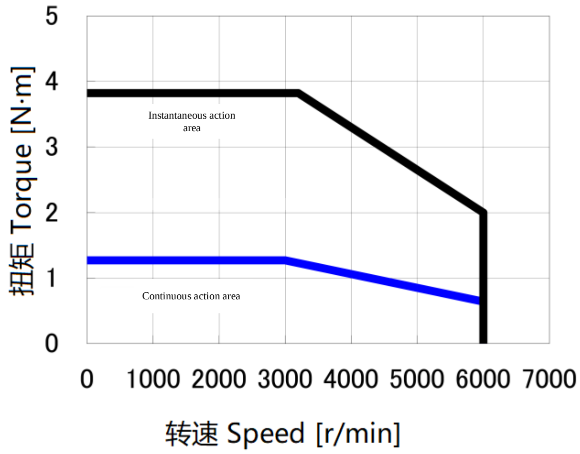
OMH1201	
Without oil seal	With oil seal

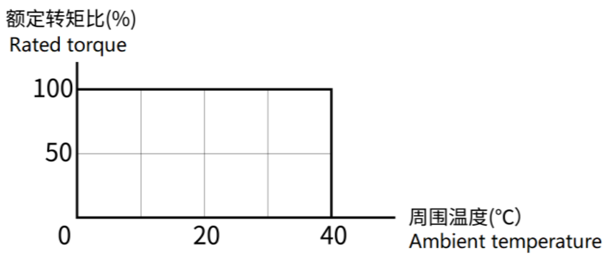


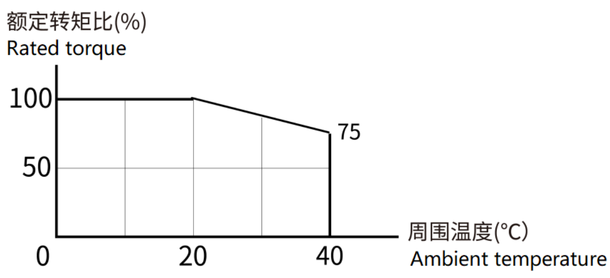




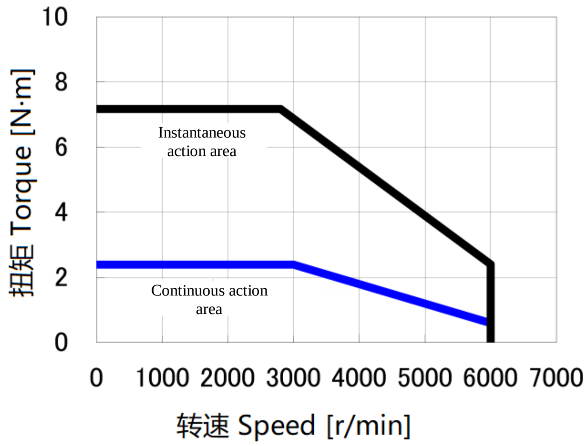
OMH1401	
Without oil seal	With oil seal

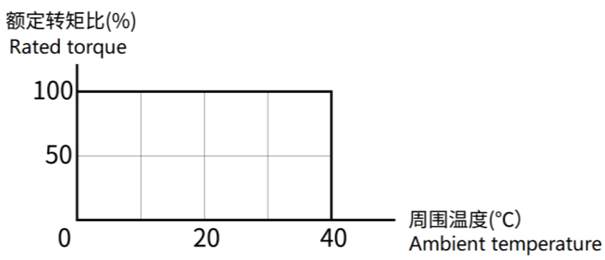


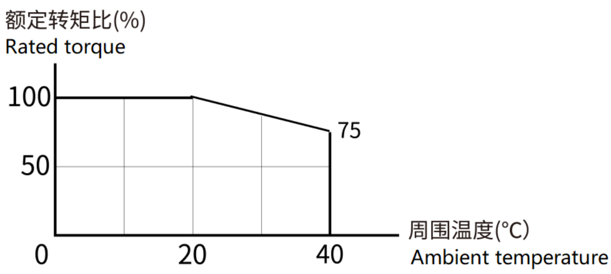




OMH1751	
Without oil seal	With oil seal







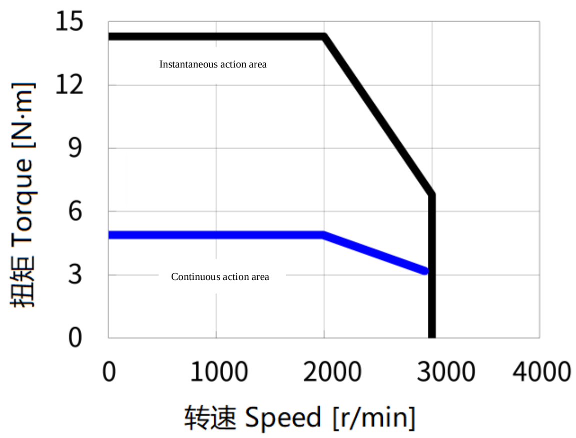
8. OMH1 high inertia 1.0kW, 1.5kW

Items	Unit	Specification	
Motor model	-	OMH1102	OMH1152

			High inertia	High inertia
Flange size		mm	□130	
Driver supply voltage		V	AC220	
Rated output		kW	1.0	1.5
Rated torque		N·m	4.77	7.16
Max torque		N·m	14.3	21.5
Rated current		A	5.6	9.0
Highest current		A	16.8	27
Rated speed		r/min	2000	
Maximum speed		r/min	3000	
Torque constant		N・m/A	0.88	0.81
Opposite potential constant		mV/(r/min)	30.9	28.4
Rate of change of rated power	Without brake	kW/s	9.2	13.8
	With brake		8.6	13.3
Mechanical time constant	Without brake	ms	4.17	3.32
	With brake		4.43	3.46
Mechanical time constant		ms	10.1	12.2
Rotor inertia	Without brake	$\times 10^{-4}$kg・m^2	24.9	37.12
	With brake		26.4	38.65
Armature wire resistance		Ω	0.88	0.40
Armature wire inductance		mH	10.0	5.0
Number of pole pairs of motor		-	5 pole pairs	
Insulation grade		-	Class F	
Weight	Without brake	kg	7.6	9.0
	With brake		9.0	10.4
Cooling conditions		TUV certification conditions	Approximately 260 mm×260 mm L type radiator (aluminum)	
		UL certification conditions	400mmt=20 aluminum radiator	

S-T characteristics/continuous torque-ambient temperature

OMH1102	
Without oil seal	With oil seal



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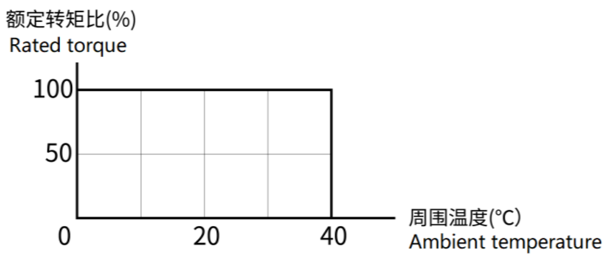
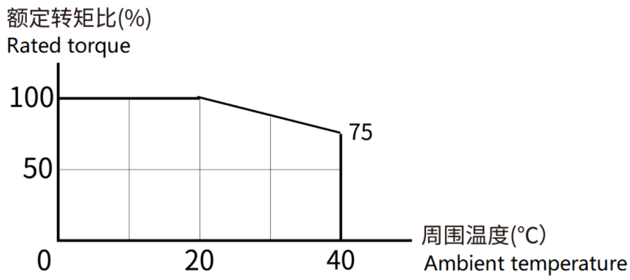
<tr><td></td><td></td></tr>
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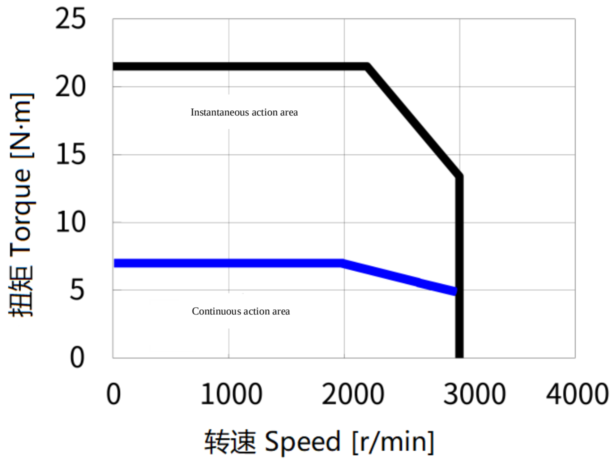
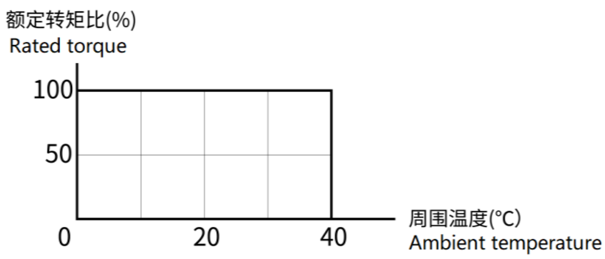
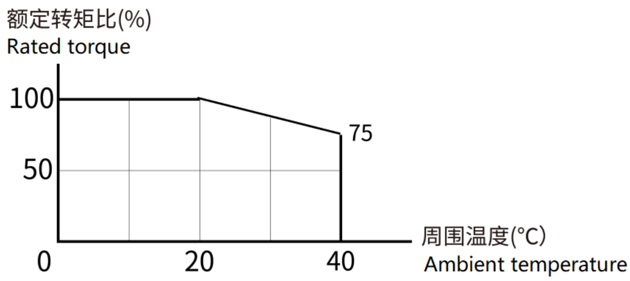
<tr><td colspan="2"></td></tr>
<tr><td></td><td></td></tr>
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9.4.2 OM2 motor characteristics

1. OMS2 low inertia 100W~1.0kW

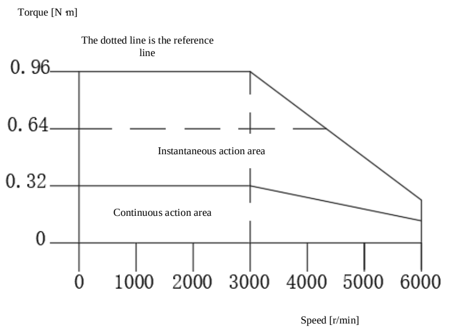
Items	Unit	Specification				
Motor model	-	OMS2101 Low inertia	OMS2201 Low inertia	OMS2401 Low inertia	OMS2751 Low inertia	OMS2951 Low inertia
Driver supply voltage	V	AC220				
Rated power	W	100	200	400	750	1000
Number of pole pairs	-	5 pole pairs				
Rated torque	N m	0.32	0.64	1.27	2.39	3.18
Max torque	N m	0.96	1.92	3.8	7.2	9.54
Rated speed	rpm	3000				
Maximum speed	rpm	6000	6000	6000	6000	4500
Rated current	A	1.4	2.1	3.2	4.8	4.9

Highest current	A	4.2	6.3	9.6	13.4	14.7
Rated frequency	Hz	250				
Torque constant	N m/A	0.23	0.304	0.396	0.498	0.649
Opposite potential constant	mV/(r/min)	10.1	12.7	15.5	20.2	25.0
Moment of inertia — Without brake	$\times 10^{-4}$kg · m^2	0.048	0.15	0.27	0.9	1.0
Moment of inertia — With brake	$\times 10^{-4}$kg · m^2	0.05	0.17	0.29	1.0	1.1
Armature wire resistance	Ω	8.67	4.03	2.36	0.93	1.1
Armature wire inductance	mh	7.68	9.35	5.8	4.2	5.81
Insulation grade	-	Class F				

S-T characteristics

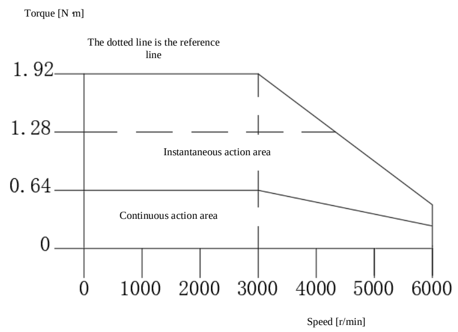
OMS2101

40 flange 100W
Dynamic torque characteristic: with/without oil seal



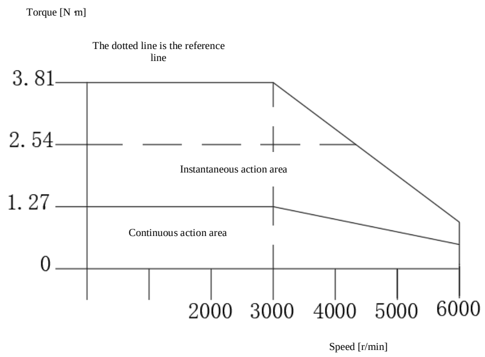
OMS2201

60 flange 200W
Dynamic torque characteristic: with/without oil seal



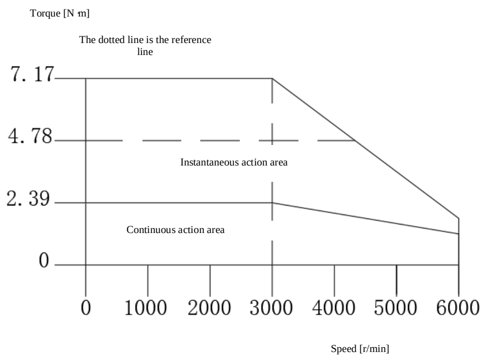
OMS2401

60 flange 400W
Dynamic torque characteristic: with/without oil seal



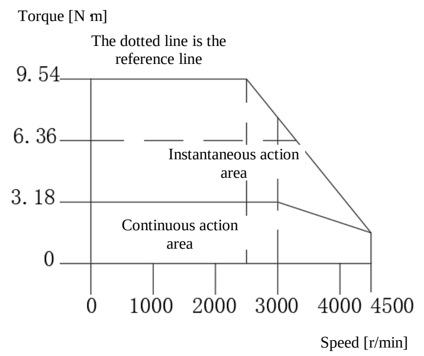
OMS2751

80 flange 750W
Dynamic torque characteristic: with/without oil seal



OMS2951

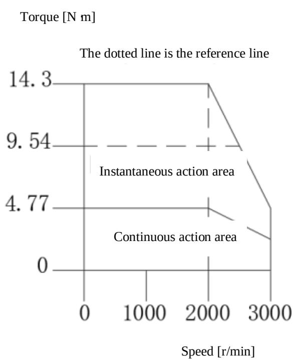
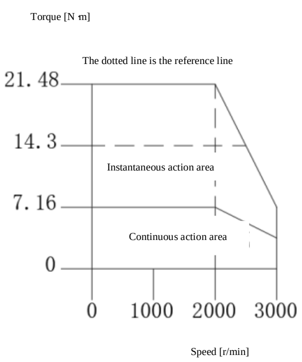
80 flange 1.0KW
Dynamic torque characteristic: with/without oil seal

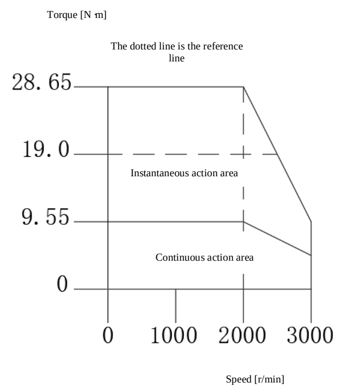
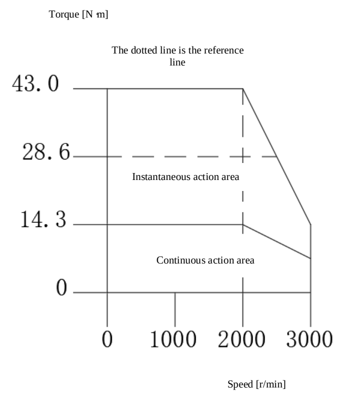


2. OMM2 medium inertia 1.0kW~3.0kW

Items		Unit	Specification			
Motor model		-	OMM2102 Medium inertia	OMM2152 Medium inertia	OMM2202 Medium inertia	OMM2302 Medium inertia
Driver supply voltage		V	AC220			
Rated power		kW	1.0	1.5	2.0	3.0
Number of pole pairs		-	5 pole pairs			
Rated torque		N m	4.77	7.16	9.55	14.3
Max torque		N m	14.3	21.48	28.65	42.9
Rated speed		rpm	2000			
Maximum speed		rpm	3000			
Rated current		A	6.0	8.2	10.0	13.8
Highest current		A	18.0	24.6	31.5	41.4
Rated frequency		Hz	166.6			
Torque constant		N m/A	0.795	0.873	8.7	1.04
Opposite potential constant		mV/(r/min)	29.5	31.7	10.7	37.5
Moment of inertia	Without brake	$\times 10^{-4}$kg・m^2	4.6	6.7	8.7	15.1
	With brake		6.6	8.7	10.7	17.1
Armature wire resistance		Ω	0.955	0.7	0.54	0.3
Armature wire inductance		mh	7.96	6.1	5.91	3.43
Insulation grade		-	Class F			

S-T characteristics

OMM2102	OMM2152
130 flange 1.0kW Dynamic torque characteristic: with/without oil seal	130 flange 1.5kW Dynamic torque characteristic: with/without oil seal
	

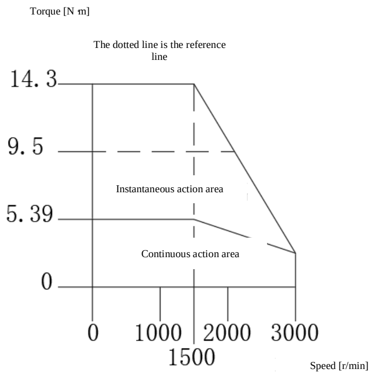
OMM2202	OMM2302
130 flange 2.0kW Dynamic torque characteristic: with/without oil seal	130 flange 3.0kW Dynamic torque characteristic: with/without oil seal
	

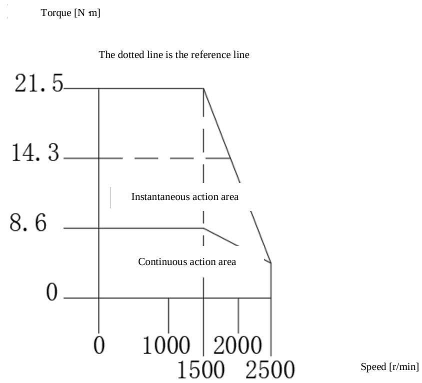
3. OMG2 high inertia 850W, 1.3kW, 1.8kW

Items		Unit	Specification		
Motor model		-	OMG2851 High inertia	OMG2132 High inertia	OMG2182 Medium inertia
Driver supply voltage		V	AC220		
Rated power		kW	0.85	1.3	1.8
Number of pole pairs		-	5 pole pairs		
Rated torque		N m	5.39	8.6	11.5
Max torque		N m	14.3	21.48	28.65
Rated speed		rpm	1500		
Maximum speed		rpm	3000	2500	3000
Rated current		A	7.0	7.6	12.2
Highest current		A	19.0	19.0	31.5
Rated frequency		Hz	125		
Torque constant		N m/A	0.77	1.13	0.905
Opposite potential constant		mV/(r/min)	29.5	38.3	35.2
Moment of inertia	Without brake	10^-4Kg m2	13.9	20	26
	With brake		15.9	22	28
Armature wire resistance		Ω	0.87	1.0	0.54
Armature wire inductance		mh	8.87	8.8	5.91
Insulation grade		-	Class F		

S-T characteristics

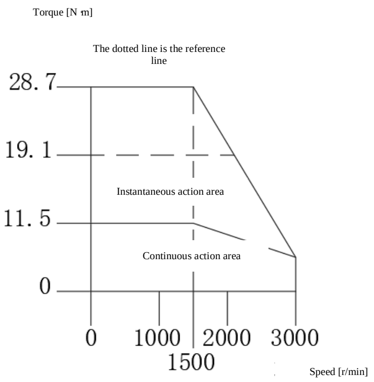
OMG2851	OMG2132
130 flange 0.85kW Dynamic torque characteristic: with/without oil seal	130 flange 1.3kW Dynamic torque characteristic: with/without oil seal





OMG2182

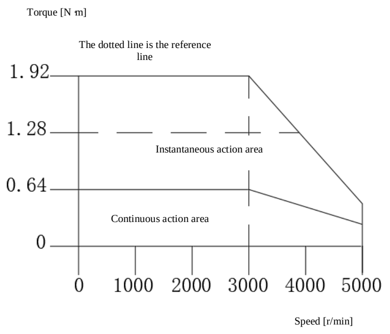
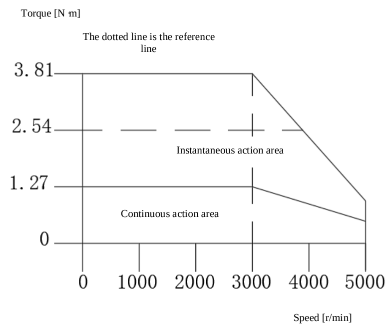
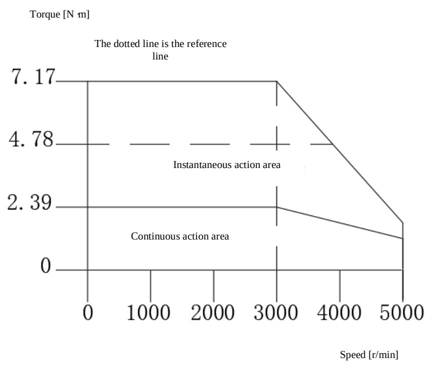
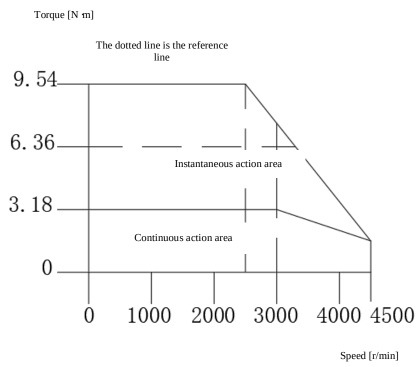
130 flange 1.8kW
Dynamic torque characteristic: with/without oil seal



4. OMH2 high inertia 200W~1.0kW (☐80)

Items		Unit	Specification			
Motor model		-	OMH2201 High inertia	OMH2401 High inertia	OMH2751 High inertia	OMH2951 High inertia
Driver supply voltage		V	AC220			
Rated power		W	200	400	750	1000
Number of pole pairs		-	5 pole pairs			
Rated torque		N m	0.64	1.27	2.39	3.18
Max torque		N m	1.92	3.8	7.2	9.54
Rated speed		rpm	3000			
Maximum speed		rpm	5000	5000	5000	4500
Rated current		A	1.90	2.8	4.0	4.9
Highest current		A	5.70	8.4	12.0	14.7
Rated frequency		Hz	250			
Torque constant		N m/A	0.337	0.453	0.597	0.649
Opposite potential constant		mV/(r/min)	13.2	16.9	22.9	25.0
Moment of inertia	Without brake	$\times10^{-4}$kg・m^2	0.57	0.67	1.5	2.38
	With brake		0.59	0.69	1.6	2.48
Armature wire resistance		Ω	4.5	3.3	1.4	1.1
Armature wire inductance		mh	12.5	9.61	7.25	5.81
Insulation grade		-	Class F			

S-T characteristics

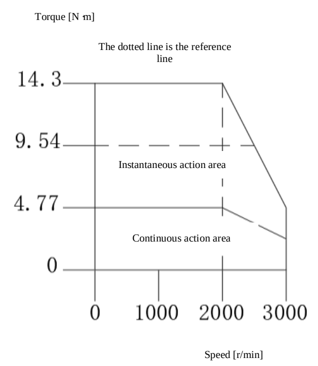
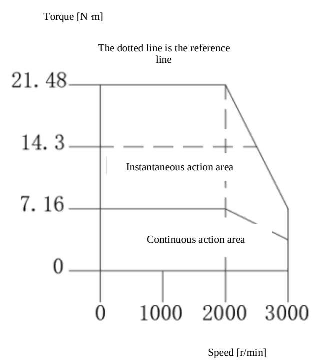
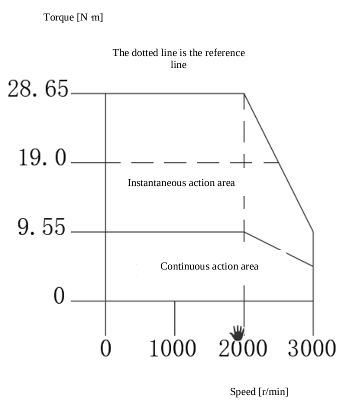
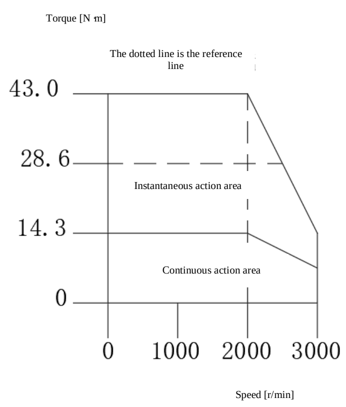
OMH2201	OMH2401
60 flange 200W Dynamic torque characteristic: with/without oil seal	60 flange 400W Dynamic torque characteristic: with/without oil seal
 	
OMH2751	**OMH2951**
80 flange 750W Dynamic torque characteristic: with/without oil seal	80 flange 1.0KW Dynamic torque characteristic:suitable to low/high inertia, with/without oil seal
 	

5. OMH2 high inertia1.0kW (□130)~3.0kW

Items		Unit	Specification			
Motor model		-	OMH2102 High inertia	OMH2152 High inertia	OMH2202 High inertia	OMH2302 High inertia
Driver supply voltage		V	AC220			
Rated power		kW	1.0	1.5	2.0	3.0
Number of pole pairs		-	5 pole pairs			
Rated torque		N m	4.77	7.16	9.55	14.3
Max torque		N m	14.3	21.48	28.65	42.9
Rated speed		rpm	2000			
Maximum speed		rpm	3000			
Rated working current		A	6.0	8.2	10.0	13.8
Highest working current		A	18.0	24.6	31.5	41.4
Rated frequency		Hz	166.6			
Torque constant		N m/A	0.795	0.873	0.905	1.04
Opposite potential constant		mV/(r/min)	29.5	31.7	61	65
Moment of inertia	Without brake	10^-4Kg m2	13.9	20	26	32.4
	With		15.9	22	28	34.4

brake					
Armature wire resistance	Ω	0.955	0.7	0.54	0.3
Armature wire inductance	mh	7.96	6.1	5.91	3.43
Insulation grade	-	Class F			

S-T characteristics

<table>
<tr><th>OMH2102</th><th>OMH2152</th></tr>
<tr><td>130 flange 1.0kW
Dynamic torque characteristic: with/without oil seal</td><td>130 flange 1.5KW
Dynamic torque characteristic: with/without oil seal</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><th>OMH2202</th><th>OMH2302</th></tr>
<tr><td>130 flange 2.0kW
Dynamic torque characteristic: with/without oil seal</td><td>130 flange 3.0KW
Dynamic torque characteristic: with/without oil seal</td></tr>
<tr><td>
</td><td>
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9.5 Optional parts

STEP special USB to RS232 adapter

9.5.1 Brake module

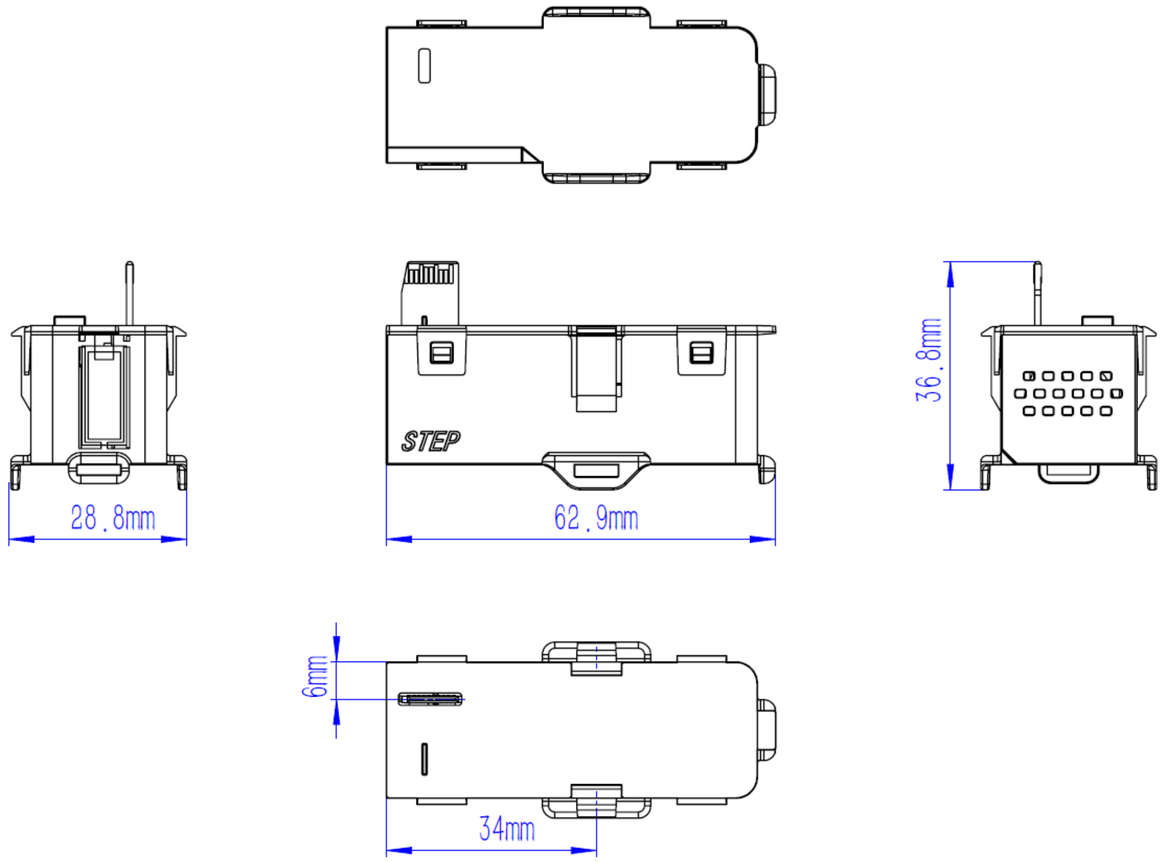


Figure 9.5.1-1 Brake module dimensions

To simplify the customer's wiring and improve the system security, the driver is provided with a separate contracting brake driver module for customers to choose. This module needs to provide an additional 24V power supply to drive the motor brake.

Brake module parameters
Voltage range: 24V±24V
Current range: 0.3A~3A
Overload protection: Yes
Open circuit protection: Yes
Definition of contracting brake module port:

+24V
BR+
BR−
GND

Name	Signs	Connector pin No.	Content
Brake power supply	+24V	4	External power for brake power supply
Positive end of brake	BR+	3	Brake positive
Negative end of brake	BR-	2	Brake negative
Negative end of brake power supply	GND	1	External power grounding for brake power supply

9.5.2 Battery box

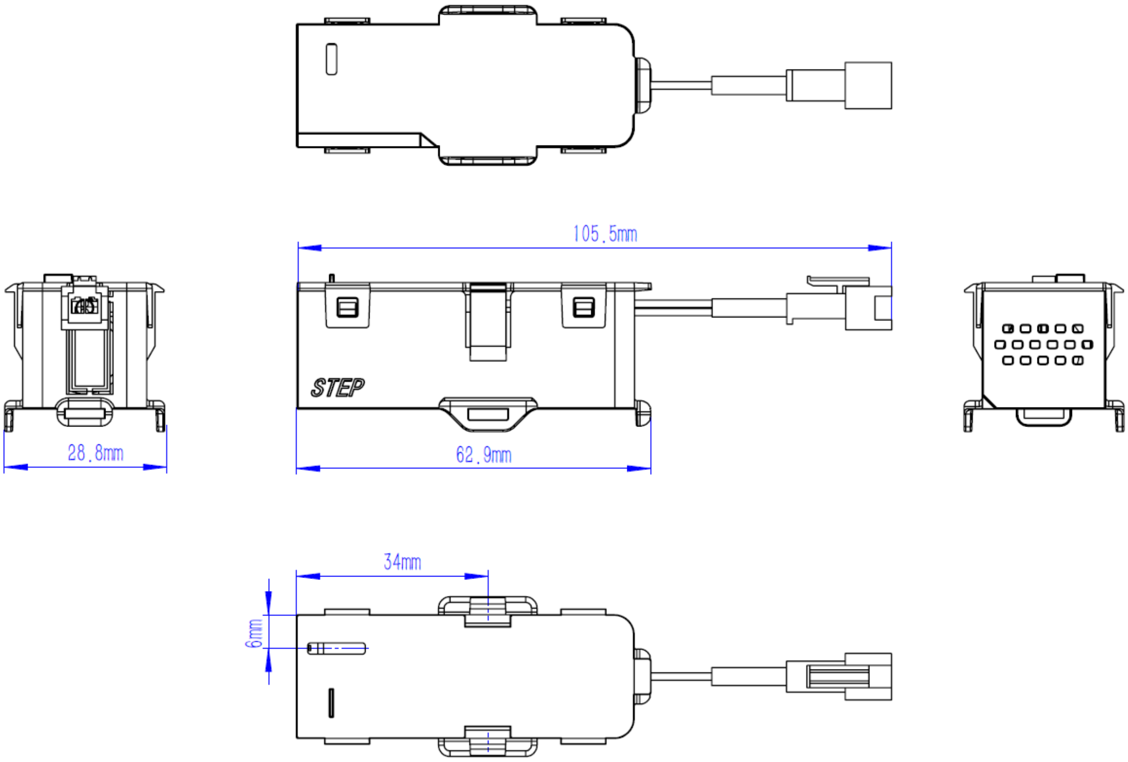


Figure 9.5.2-1 Battery box dimensions

The battery box is used for placing the external battery of motor encoder. Please refer to the battery specification definition for wiring.

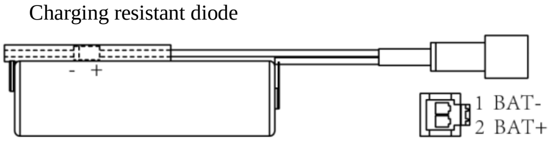


Figure 9.5.2-2 Battery box wiring definition diagram

To connect to the motor encoder, it is required to make sure that whether the wiring definition is consistent or not. In case of inconsistency, the battery and the motor encoder may be damaged.

9.5.3 Wireless module

Ω6 series servo allows the connection of WIFI module to CN1 (USB-typeC), to realize wireless communication through the adaptive Ω-master upper computer software.

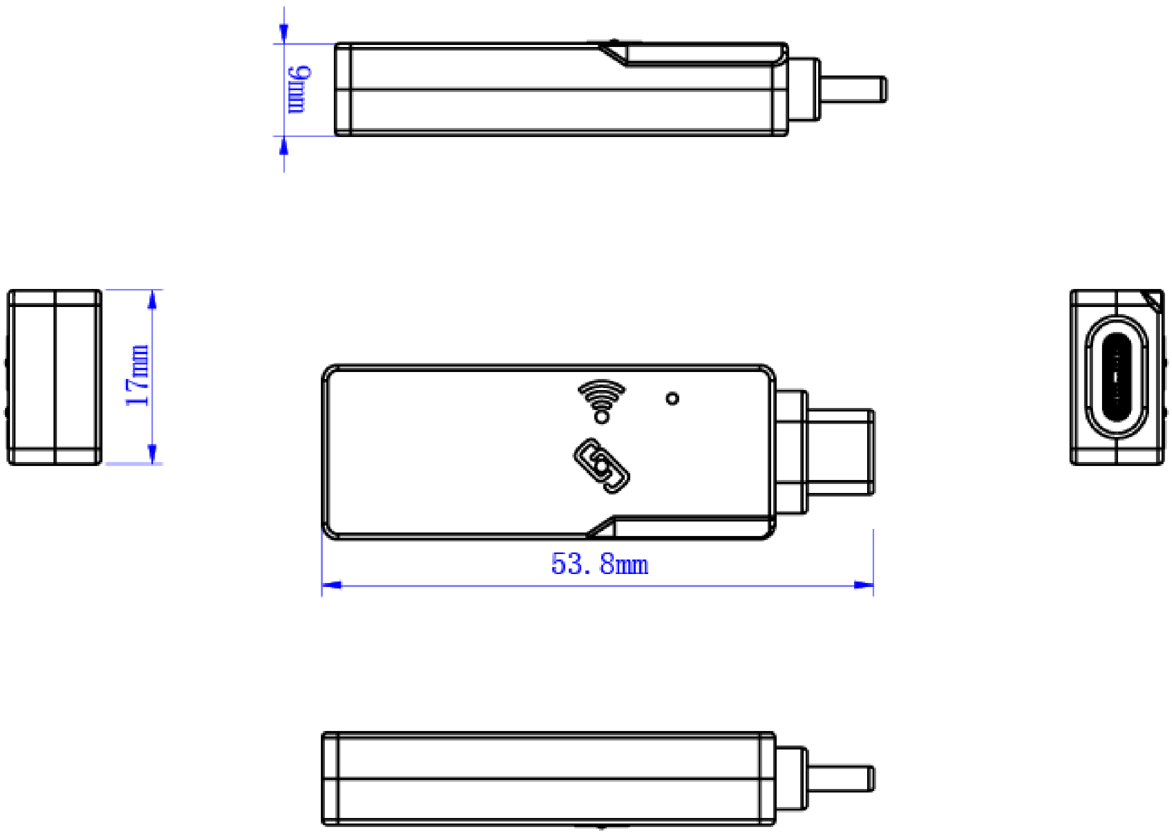


Figure 9.5.3-1 Wireless module dimensions

Wireless module specification

Working voltage	5V ±10%
Working current	0.2mA
Wireless standard	WIFI-2.4G
Wireless channel	Channel 1~11
Connection distance	AP mode 5m STA mode 10m
Working mode	AP mode and STA mode
Wireless rate	2Mbps
Wireless protocol	Ω Master proprietary protocol

9.5.4 External brake resistor

When the servo driver brakes, the motor feeds back the energy to the driver, and the bus voltage will increase, which is called renewable power. Renewable power can only be absorbed by internal bus capacitance. If the voltage on the bus capacitor exceeds the threshold that the capacitor can bear, the brake circuit in the driver will be activated, and the excess energy will be discharged through the braking resistor. When the built-in braking resistor cannot fully absorb the regenerating energy, an external braking resistor with high power and

small resistance is required to complete the absorption of the regenerating energy. With the appearance shown as below, the external braking resistor is recommended to be used in the environment with a booster fan.

Figure 9.5.4-1 External braking resistor diagram

The recommended external braking resistors corresponding to different types of drivers are as follows:

Resistor model	Value of resistance	Rated power	Driver model
RXLG-50W100RJ	100Ω	50W	ODSA□6A201□B
RXLG-100W60RJ	60Ω	100W	ODSA□6A401□B
RXLG-100W50RJ	50Ω	100W	ODSA□6A751□B
RXLG-120W40RJ	40Ω	120W	ODSA□6A102□B
RXLG-150W30RJ	30Ω	150W	ODSA□6A152□B
RXLG-120W30RJ	30Ω	120W	ODSA□6A202□B
RXLG-150W25RJ	25Ω	150W	ODSA□6A302□B

9.5.5 RS232 to RS485 module

Optional accessories are provided for RS232 to RS485 module, to convert RS485 interface of Ω6 servo into RS232 interface when RS232 communication is needed.

Performance parameters:

Interface characteristic	The interface is compatible with the RS-232C and RS485 standards of EIA/TIA
Electrical interface	DB9 port connector at RS-232 end, 9-pin connector at RS-485 end
Working mode	Asynchronous half-duplex differential transmission
Transmission medium	Twisted-pair (wire diameter greater than or equal to 0.5mm2) or shielded wire
Transmission rate	300-115.2KBPS
Use environment	-20℃ to 70℃, relative humidity 5%-95%
Transmission distance	1200M (RS-485),15M (RS-232)
Communication mode	Point-to-point, two-wire half duplex and point-to-multipoint, two-wire half duplex

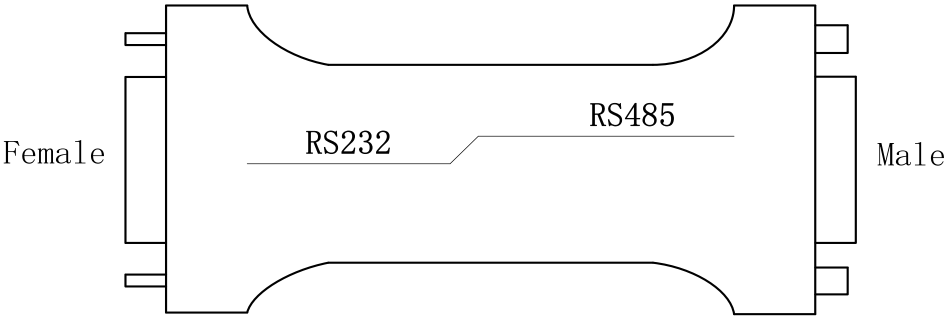


Figure 9.5.5-1 RS232 to RS485 module diagram

Interface definition:

DB9 Female (PIN)	RS-232C interface signal
1	Protective grounding
2	Receive data SIN (RXD)
3	Send data SOUT(TXD)
4	Data terminal ready DTR
5	Signal ground GND
6	Data set ready DTR
7	Request to send RTS
8	Clear to send CTS
9	Ring indicator RI

DB9 Male (PIN)	Output signal	RS-485 half duplex wiring
7	T/R+	RS-485 (A+)
2	T/R-	RS-485 (B-)
5	GND	Ground wire

TIPS Note:

Although this product is a passive product, it does not indicate no power supply to the module circuit. The module mainly receives power through serial port 9-pin, so RS232 can communicate normally only on the premise of standard 9-pin or USB to RS232. For example, when some serial ports do not have a power supply pin, (9-12V) DC should be supplied at pin 7 of 9-pin.

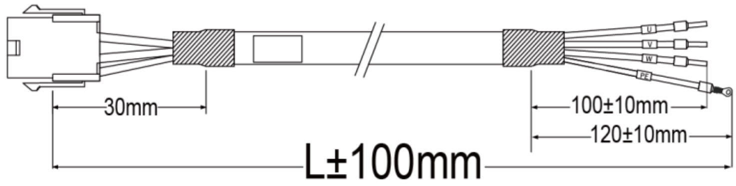
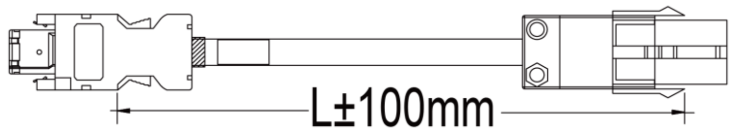
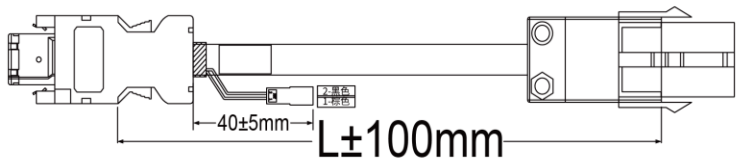
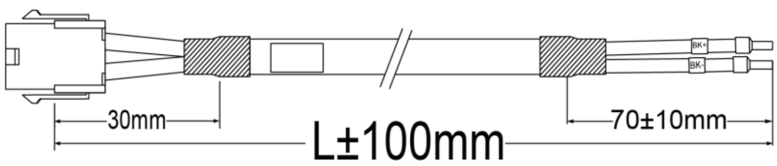
9.5.6 Matching cables and connectors

1. Identification method of model

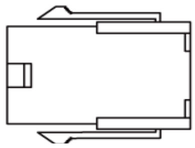
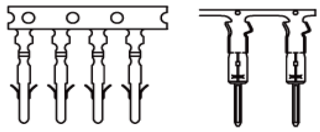
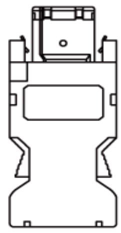
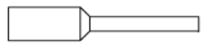
OLE	-	S	-	H	S	0	1	-	100	-	1	-	*
1-3		4		5	6	7	8		9-11		12		13

[1-3] cable usage OLE: Encoder cable OLD: Power cable OLB: Brake cable	[4] Motor code N: No special definition S: Sig rine OM1 Z: Sigriner OM2	[5] Cable specification S: Ordinary cable G: High flexible cable H: Super flexible cable
[6] Encoder/brake type Encoder brake D: Incremental encoder S: Absolute value encoder (With battery box) Brake B: With brake N: Without brake	[7] cable diameter 0: 0.2mm²/24AWG 1: 0.3mm²/22AWG 2: 0.75mm²/18AWG 3: 1.5mm²/15AWG 4: 2.5mm²/13AWG	[8] Drive side type Power line/brake joint 1: Pin type+heteromorphosis 2: Full pin type Encoder terminal 5: 6PIN1394 6: 10PIN1394
[9-11] Cable length 030: 3.0M 050: 5.0M 080: 8.0M 100: 10.0M	[12] Motor side terminal type Power line terminal 1: Lattice 2: Military rules 18-10 linear type 3: Military rules 18-10 orthogonal type 4: Military rules 20-4 linear type 5: Military rules 20-4 orthogonal type 8: Military rules 20-18 linear type 9: Military rules 20-18 orthogonal type A: Military rules 24-11 linear type B: Military rules 24-11 orthogonal type Brake side 0: No separate brake terminal 1: Lattice 2: 22PIN aviation plug linear type 3: 2PIN aviation plug orthogonal type Encoder terminal 1: 6/9 lattice 2: 10PIN aviation plug linear type 3: 10PIN aviation plug orthogonal type 4: Military rules 20-29 linear type 5: Military rules 20-29 orthogonal type	[13] Special number Vacancy: Standard cable

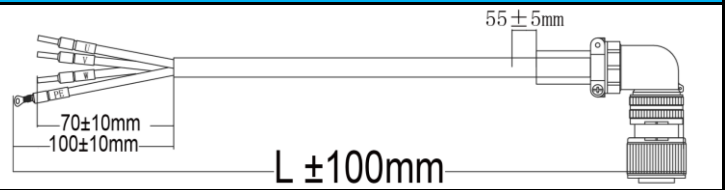
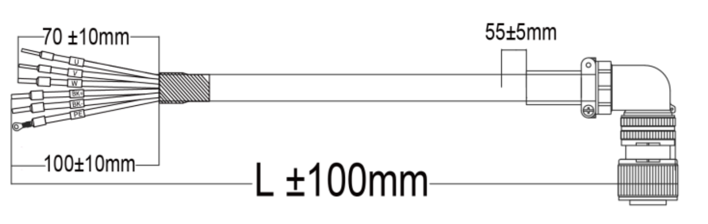
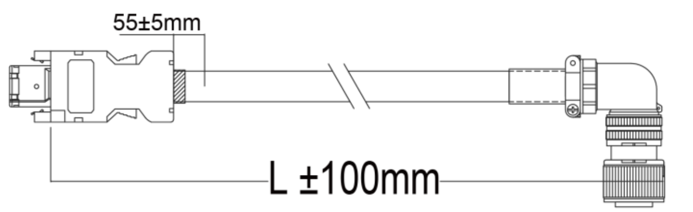
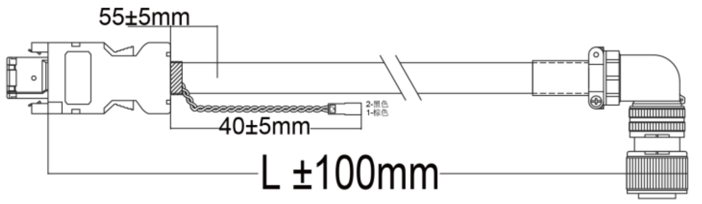
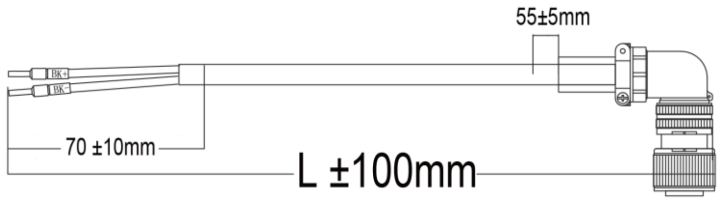
2. 1.0kW (□80) and below motor matching cable selection (850W excluded)

Motor model	Cable name	Cable model	Cable appearance diagram
OM□□	Power line of motor without brake	OLD-□-□ N31-030-1-*	
		OLD-□-□ N31-050-1-*	
		OLD-□-□ N31-080-1-*	
		OLD-□-□ N31-100-1-*	
	Absolute value of single turn/ABZ motor encoder wire	OLE-□-□D0□ -030-1-*	
		OLE-□-□D0□ -050-1-*	
		OLE-□-□D0□ -080-1-*	
		OLE-□-□D0□ -100-1-*	
	Multiturn absolute value motor encoder line	OLE-□-□S0□ -030-1-*	
		OLE-□-□S0□ -050-1-*	
		OLE-□-□S0□ -080-1-*	
		OLE-□-□S0□ -100-1-*	
	Brake cable	OLB-□-□ B22-030-1-*	
		OLB-□-□ B22-050-1-*	
		OLB-□-□ B22-080-1-*	
		OLB-□-□ B22-100-1-*	

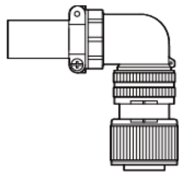
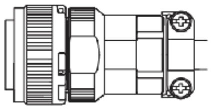
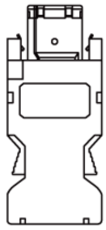
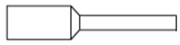
3. 1.0kW (□80) and below motor cable connector model (850W excluded)

Motor model	Name and location	Connector	Connector model	Connector appearance
OM□1	Incremental encoder motor side	Connector	172160-1	
		Wire pressing terminal	170365-1	
	Absolute encoder motor side	Connector	TE-172161-1	 Rectangular housing
		Wire pressing terminal	170365-1	
	Power supply motor side	Connector	TE-172330-1	 Wire pressing terminal
		Wire pressing terminal	170366-1	
	Brake cable motor side	Connector	TE-172328-1	
		Wire pressing terminal	170366-1	
OM□2	Encoder motor side	Connector	TE-172161-1	 Encoder connector
		Wire pressing terminal	170365-1	
	Power supply motor side	Connector	TE-172330-1	
		Wire pressing terminal	170366-1	
		Tubular cold-pressed terminal	E7510	 Tubular cold-pressed terminal
		Round cold-pressed terminal	RV1.25-4	 Round cold-pressed terminal
	Brake cable motor side	Connector	TE-172328-1	
		Wire pressing terminal	170366-1	
Drive side encoder connector		The 1st encoder	1394-6P male connector	
		The 2nd encoder	MUF-PK10K-X	

4. 850W ~3.0kW motor matching cable selection (1.0kW excluded (□80))

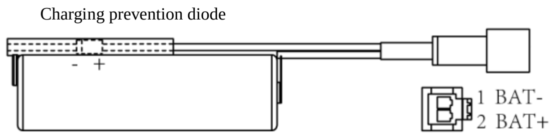
Motor model	Cable name	Cable model	Cable appearance diagram
OM□1 OM□2	Non-brake motor power line	OLD-□-□N□1-030-□-*	
		OLD-□-□N□1-050-□-*	
		OLD-□-□N□1-080-□-*	
		OLD-□-□N□1-100-□-*	
	Brake motor power line	OLD-□-□B□1-030-□-*	
		OLD-□-□B□1-050-□-*	
		OLD-□-□B□1-080-□-*	
		OLD-□-□B□1-100-□-*	
	Absolute value of single turn/ABZ motor encoder wire	OLE-□-□D□□-030-□-*	
		OLE-□-□D□□-050-□-*	
		OLE-□-□D□□-080-□-*	
		OLE-□-□D□□-100-□-*	
	Multiturn absolute value motor encoder line	OLE-□-□S0□-030-□-*	
		OLE-□-□S0□-050-□-*	
		OLE-□-□S0□-080-□-*	
		OLE-□-□S0□-100-□-*	
	Brake cable	OLB-□-□B22-030-□-*	
		OLB-□-□B22-050-□-*	
		OLB-□-□B22-080-□-*	
		OLB-□-□B22-100-□-*	

5. 850W ~3.0 kW motor cable connector model (1.0kW excluded (□80))

Motor model	Name and location	Connector	Connector model	Connector appearance
OM□1	Encoder motor side	Straight line	SC-CMV1-SP10C	 Right-angle aviation plug  Linear aviation plug  Encoder connector  Tubular cold-pressed terminal  Round cold-pressed terminal
		Right angle	SC-CMV1-AP10C	
	Power supply motor side	Straight line	CMS3106A18-10S	
		Right angle	CMS3108A18-10SI	
	Brake cable	Straight line	SC-CMV1-SP02C	
		Right angle	SC-CMV1-AP02C	
OM□2	Encoder motor side	Right angle	CMS3108A20-29SI	
		Straight line	CMS3106A20-29S	
	Power supply motor side	Right angle	CMS3108A20-4SI	
		Straight line	CMS3106A20-4S	
		Right angle	CMS3108A20-18SI	
		Straight line	CMS3106A20-18S	
		Tubular cold-pressed terminal	E1510	
		Round cold-pressed terminal	RV1.25-4	
Drive side encoder connector		The 1st encoder	1394-6P male connector	
		The 2nd encoder	MUF-PK10K-X	

9.5.7 Battery for absolute encoder

1. Battery for absolute encoder

Name	EVE battery	Battery appearance
Model	ER14505	
Battery size	D14.55mm* H50.5mm	
Standard voltage	3.6V	
Rated capacity	2700mAH	
Maximum sustained discharge current	40mA	
Operating temperature	-60--+85℃	

After-sales service

Repair and maintenance

1. Please contact the product agent 1st for the repair and maintenance;
If the product has been installed in the equipment, please contact the equipment manufacturer first.

Technical service

Technical consultation from customers (model selection and usage method of motors and drivers)
Tel.: (86)13585858922 (Engineer Jiang)
(86) 18567767212 (Engineer Ma)
Consultation time: 9:00--17:30 from Monday to Sunday (except for certain holidays)
After-sales technology and maintenance consultation (repair of faulty parts, purchase of repair parts and optional accessories)
After-sales support: (86)18816691165 (Engineer Guo)
Purchase consultation: (86) 13818127817 (Engineer Liu)
Consultation time: 9:00--17:30 from Monday to Sunday (except for certain holidays)
Manufacturing base: Shanghai STEP Electric Corporation
Add.: 1560Siyi Road, Jiading District, Shanghai City
Tel.: 021-31026318
Website: www.step-sigriner.com.cn
Internet technology information

Official official account   Official website